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# ARMY ORDNANCE

VOL. VIII WASHINGTON, D. C., NOVEMBER-DECEMBER, 1927 No. 45

AN AIRPLANE VIEW OF WATERVLIET ARSENAL, WATERVLIET, N. Y.

THE WATERVLIET ARSENAL
Col. E. D. Bricker, Ord. Dept., U. S. A.

MANUFACTURE OF CANNON AT WATERVLIET ARSENAL
Hugh Smith

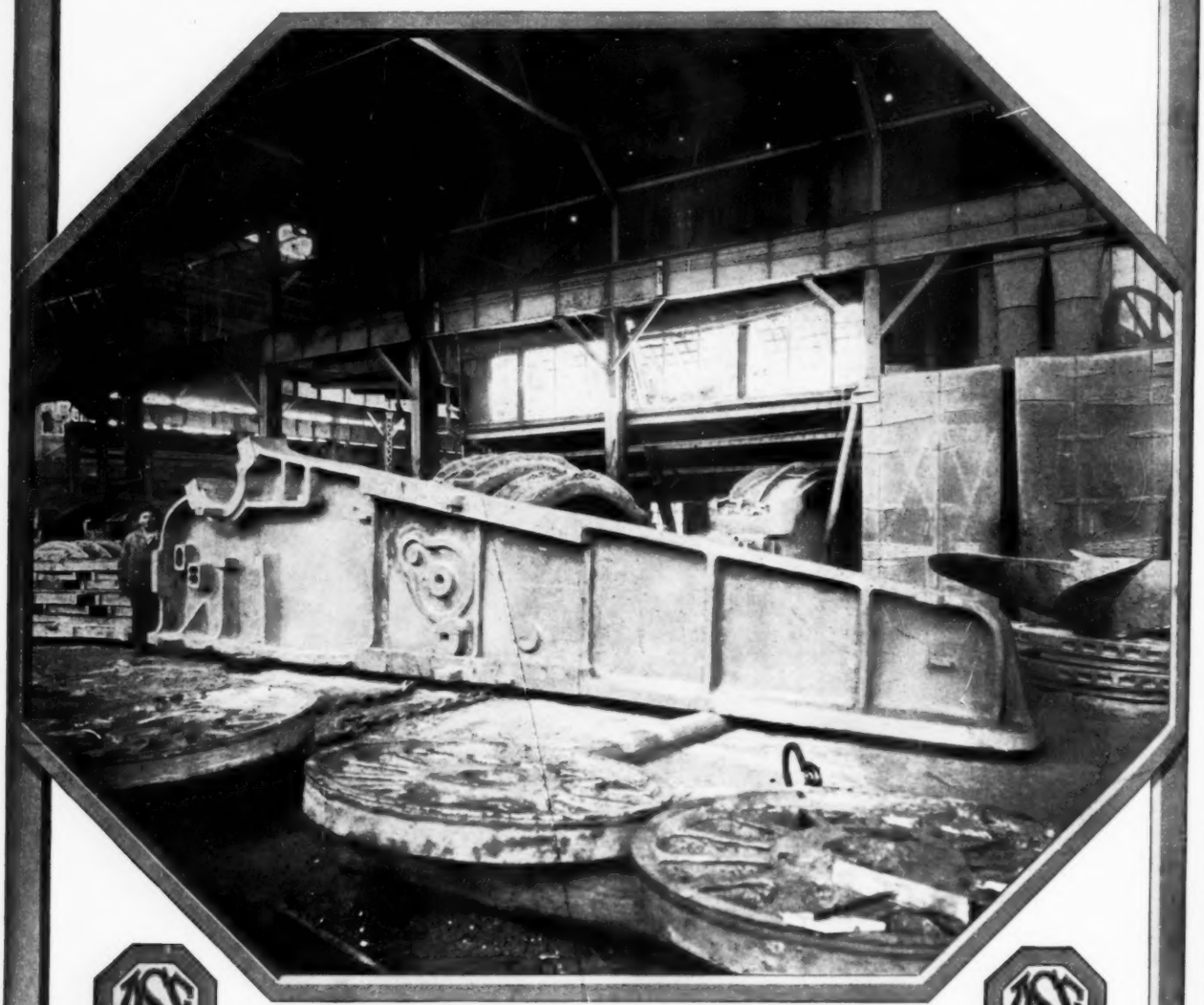
PRESENT TREND IN BREECH MECHANISM DESIGN
John DeVoge

SHRINKAGE OPERATIONS ON BUILT-UP CANNON
Oscar Olson

THE NINTH ANNUAL MEETING OF THE ARMY ORDNANCE ASSOCIATION

AOA
THE JOURNAL OF THE ARMY ORDNANCE ASSOCIATION

# AMERICAN STEEL FOUNDRIES



STEEL CASTINGS
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ARMY AND NAVY REQUIREMENTS

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# ARMY ORDNANCE

The Journal of the Army Ordnance Association

Pledged to Public Service in Effecting Industrial Preparedness for War as Our Strongest Guarantee of Peace



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Volume VIII | NOVEMBER-DECEMBER, 1927 | Number 45


## CONTENTS


| | Page |
|---|---|
| The Lafayette Gun at Watervliet Arsenal | Frontispiece |
| Watervliet Arsenal—Its History and Place in our Plan of National Defense, By Col. E. D. Bricker, Ord. Dept., U. S. A. | 133 |
| The Reserve Officer—His Place in Peace and War Organization of Watervliet Arsenal, By Maj. E. P. King, Ord. Res., U. S. A. | 141 |
| Commanding Officers of Watervliet Arsenal, 1826-1927 | 142 |
| The Twenty-Year Club of the Watervliet Arsenal . . . . . By John P. Dorney | 143 |
| The Buffalo Ordnance District . . . . By Capt. R. E. Hardy, Ord. Dept., U. S. A. | 144 |
| Heroes of Picatinny Disaster Honored | 148 |
| Manufacture of Cannon at Watervliet Arsenal—Development of Modern Types and Production Methods . . . . . By Hugh Smith | 149 |
| Shrinkage Operations in the Construction of Built-Up Cannon—As Practiced at the Watervliet Arsenal . . . . . By Oscar Olson | 156 |
| Our Munitions Reserve in Desperate Circumstances | 160 |
| Present Trend in Breech Mechanism Design . . . . . By John D. DeVoge | 161 |
| The 19th Ordnance Company at Watervliet Arsenal. By Capt. T. W. Conrad, Ord. Dept., U. S. A. | 168 |
| Ninth Annual Meeting, Army Ordnance Association | 171 |
| Among the Victors at National Rifle Matches | 176 |
| Editorial | 177 |
| "Practical, Realistic, Hardboiled"—Sound Preparedness Philosophy—Another Milestone—Watervliet Arsenal—Rights and Duties. | |
| Personnel | 179 |
| Training Reserve Officers in the Second Corps Area—The Aberdeen Training Camp, 1927, as Seen by an Unseen Observer—Wiggington E. Creed—New York and California Posts, A. O. A., Elect Officers. | |
| Professional | 184 |
| Discussion of "A Standard Method for Measuring Small Arms Targets"—Battleships Sunk by Bombs Salvaged—Tanks and Motorized Artillery Participate in Cavalry Maneuvers—Fire at Curtis Bay Ordnance Depot, Curtis Bay, Md. | |
| Books | 189 |
| Patents | 195 |


"The increasing interest all over the nation in industrial preparedness is a frank declaration to the world that we not only want peace but that we intend to have it."

Hanford MacNider, *Assistant Secretary of War.*

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THE Army Ordnance Association is a national organization of American citizens pledged to industrial preparedness for war as our nation's strongest guarantee of peace.

THE Association endeavors to keep alive an interest in and knowledge of the design, production and maintenance of munitions. Other than a few manufacturing arsenals—six in all—there is no peace-time industry for the production of ordnance. Should war unhappily come again, industrial America will be called upon to produce munitions in great quantity and of intricate and unusual design. In an emergency time will not permit careful study or long preparation for the production of munitions. The problem is one of vital concern.

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ARMY ORDNANCE, the journal of the Association, is published solely for the purpose of disseminating information on the progress of our munitions developments so that American industry may at all times know its responsibilities to the common defense.

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To assist in effecting industrial preparedness for war as being one of the nation's strongest guarantees of peace;

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To promote mutual understanding and to effect cooperation with American Scientists, Inventors, Engineers and Manufacturers in civil life and the Regular and Reserve Officers of the Army Ordnance Department;

To provide, when required, the services of competent committees to investigate and report upon special ordnance subjects;

To assist in developing and maintaining an efficient personnel, both commissioned and enlisted, for the units required for Ordnance Field Service in the event of an emergency;

To commemorate the services rendered by the Industry of the Nation and by the Officers and Civilian Employees of the Ordnance Department in the wars in which the United States has been engaged.

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THE LAFAYETTE GUN AT WATERVLIET ARSENAL.

GENERAL LAFAYETTE came up from Albany (September 18, 1824) on an elegant canal packet boat, accompanied by another packet boat which was filled with both military and citizens from Albany and various parts of the State. Upon arrival at the arsenal wharf, a salute of 13 guns was fired as the General disembarked. Lieut. Thomas J. Baird during the tour of the grounds told the General that he would introduce him to three of his old acquaintances and pointed to the English brass pieces of ordnance which were taken from Lord Cornwallis when his Lordship surrendered to the American and French Armies at Yorktown in 1781. Immediately he recognized one of these pieces by a deep indentation in its side where it had been struck by a cannon ball just previous to its capture. He embraced the gun and declared that it was a companion of his youth. On the occasion of Lafayette's death a few years later this piece was used in firing a salute in memory of the French hero who had done so much for American Independence.—*From Colonel Bricker's Article, "Watervliet Arsenal," page* 136.

ARMY ORDNANCE

VOL. VIII NOVEMBER-DECEMBER, 1927 No. 45

# Watervliet Arsenal

## *Its History and Place in our Plan of National Defense*

Col. E. D. Bricker, Ord. Dept., U. S. A.*

THE Watervliet Arsenal had its inception in 1813. The military necessity at the time for a depot in this locality was made apparent when the second war with England was showing the need for a more thorough protection of the Canadian border from invasion from the north. The facilities of travel afforded by the Hudson River and also by the Mohawk were large factors in determining the choice of the site, for it was before the day of rail transportation.

Main Entrance to Watervliet Arsenal.

The plans and arrangements for Watervliet Arsenal had been laid late in 1812. Writing to Hon. John Armstrong, the Secretary of War, Col. Decius Wadsworth of the Ordnance Department, penned the following under date of November 13, 1812:

"Ordnance Office,
War Department,
Washington.

"Sir,—The Ordnance Department being a new establishment in this country, and without the aid of experience, it is not surprising that some inconveniences and defects should appear in its organization * * *. The duties of the Ordnance Department should be limited to providing for and supplying the different armies, forts, posts, magazines and arsenals of the United States * * *. From Albany northward to the navigable waters of Lake Champlain is a portage of sixty miles and from Albany west, taking the difficulties of the Mohawk River as placing the navigation by water nearly on the level of that by land, we may reckon the communication with the waters of Lake Ontario as about equivalent to about 100 miles land carriage. * * * Pennsylvania has been selected for the principal Arsenal of construction for gun carriages on account of the excellence of workmanship and the materials of carriages generally throughout the State * * *. The principal establishment for making fixed ammunition and all the small articles of equipment for a train of artillery will be at Albany. The Assistant Commissary will be stationed there, with three or four Deputies. The present establishment at New York may be continued on a reduced scale as subordinate thereto * *."

Colonel Wadsworth went on to state that there would be needed one Assistant Commissary General at Albany and four Assistant Deputies. He also wrote:

"In making cartridges, children of twelve and fourteen years of age can be employed as usefully, or even more so, than men, and in making extra flannel cartridges women can be economically employed; and, as it may be advantageous, and, on particular emergencies, necessary, to employ a great many hands, the officers of the Ordnance Department should be entrusted with discretionary authority, under the Superintendent of the War Department, to hire by the day, week, or month such aid as may be wanted, in addition to the men permanently enlisted.

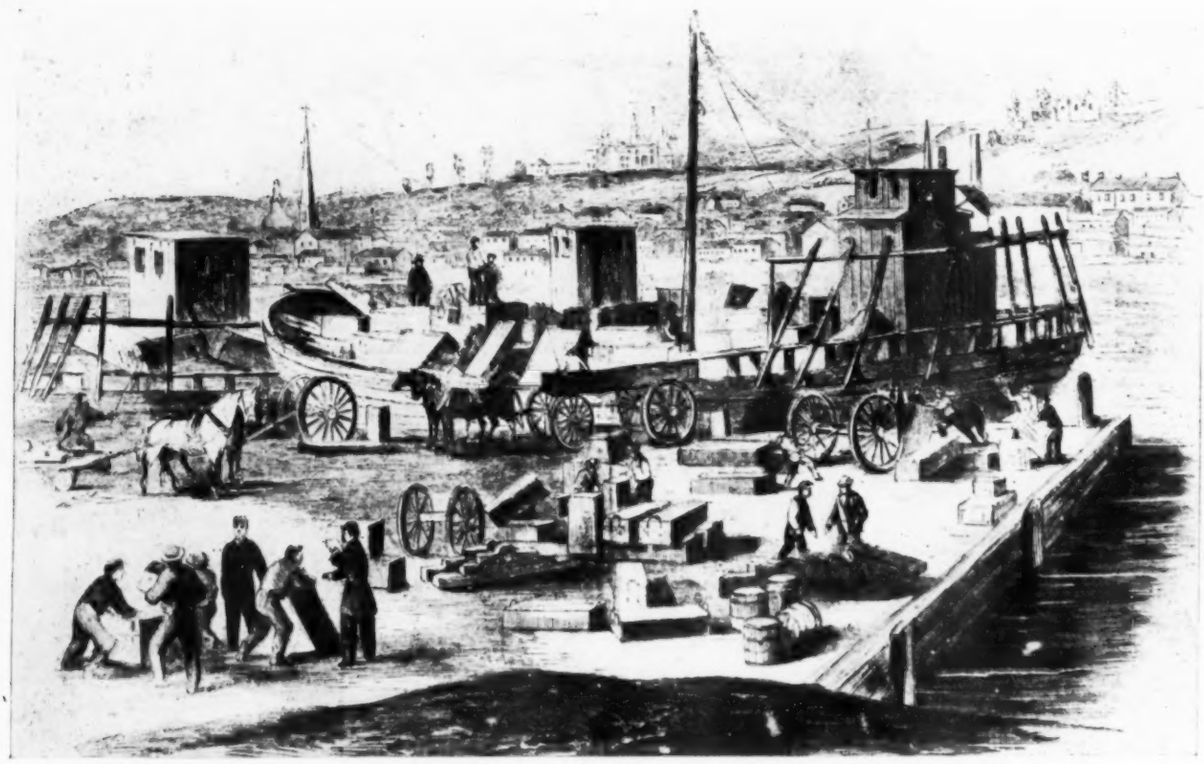
"By the existing laws the laborers are allowed only nine dollars per month and no allowance for clothing. The employments being chiefly mechanical, it is desirable they should be put on the same footing of compensation as the artificers of the Artillery. Some encouragement of that kind has perhaps been held out to them, which it may be best not to disappoint.

"The harness will constitute a part of the equipment of the artillery on traveling-carriages; therefore, a master saddler and harness-maker should be annexed to the Department, as well to inspect the harness when first received in store and attend to its preservation, as also to see to the complete equipment of the divisions of artillery in harness and saddlery when they take the field."

*Commanding Officer, Watervliet Arsenal, Watervliet, N. Y.

Colonel Wadsworth's recommendations were approved by the Secretary of War and resulted the following year in the birth of what eventually grew to be Watervliet Arsenal.

Thus was established "The Supply Depot near Albany" or "The Arsenal at Gibbonsville," the name of the small hamlet five miles north of Albany where a trifle more than 12 acres of land was purchased from James Gibbons and wife for the sum of $2,585. In the original deed the arsenal had tentative assurance that a state canal to run through the grounds would be constructed in the near future. Indeed the procurement of the right of way through the Government grounds for the Erie and Champlain Canals, which are now abandoned at this point, furnished an interesting paragraph in the early history of the arsenal.



**Shipping Gun Carriages, Ammunition, Etc., from the Watervliet Arsenal Wharf Prior to the Civil War.**

On this tract of land were erected ten modest buildings, including an office building, commissary store and paint shop, all of brick, commanding officer's quarters of brick, barracks and hospital, assistant officers' quarters, enlisted men's quarters, stables and most pretentious of all, a two-story arsenal building. The latter cost $15,000, while the total for all the buildings was approximately $40,000.

The earliest letters and post records show that Capt. Thomas L. Campbell, Ord. Dept., U. S. A., was in temporary command of "The Arsenal at Gibbonsville" on and before December 24, 1814, and remained until August 1, 1816, when he was relieved by Brevet Capt. David T. Welch, who also was in temporary command.

The first permanent commanding officer was Maj. James A. Dalliba, who was born in Connecticut and appointed to the U. S. Military Academy from that State. He was graduated fourth in his class in 1811 and appointed second lieutenant of artillery. He was promoted to first lieutenant, March 3, 1813, and made captain and deputy commissary of ordnance, August 5, 1813. During the War of 1812 he commanded the arsenals and depots at Buffalo, N. Y., Batavia, N. Y., and Rome, N. Y., together with Watervliet Arsenal, where he assumed command on November 14, 1816.

Shortly after Major Dalliba's arrival the name of the arsenal was changed to the Watervliet Arsenal. The water of the Hudson River in the early days overflowed its banks each spring and inundated the arsenal grounds to a greater or less extent and the name Watervliet, which is a Dutch word meaning "flowing stream," was no doubt selected for that reason. So apt was this appellation and so powerful its influence that the village of West Troy almost a century later had its name changed by an act of the New York State legislature to the City of Watervliet.

The old records of the arsenal for these days of its infancy are still preserved and from them much of the details of early Army life can be gleaned. Courts-martial in those days were just as formal and punishments were, if anything, more severe than in these modern times. As an illustration, a court-martial on June 23, 1815, tried one Dominic Travioli, a laborer in the United States Ordnance Department, and sentenced him as follows:

> "The court, therefore, sentences the said Travioli to be deprived of his liquor for the space of one month and to perform fifteen days of fatigue duty, also to be confined seven nights in the Black Hole commencing on the 24th inst."

There also seemed to be in these early days the same difficulties in having cash accounts approved as exists at the present time, but that Major Dalliba had a mind of his own and that he was gifted with an artistic sense is shown

in the fact that as early as the spring of 1818 he set out upon the project, justified later by 100 years' experience, of beautifying the arsenal grounds. This carefully worded letter, none the less strong because it is concealed in gallant language, tells how greatly he resented criticism and how far he was willing to justify his cause in beautifying the arsenal grounds. Here is his reference, veiled and otherwise, to his expenditures of government funds for shade trees:

Main Avenue Leading to the Office Building, Watervliet Arsenal.

"U. S. Arsenal,
Watervliet, N. Y.
August 1, 1821.

"Sir,—Your orders of the 27th July have been duly received. The subject of my cash accounts is the object of this sheet.

"The authority, upon which I purchased the shade trees for this post, was my judgment, the same authority upon which all my disbursements have been made, and in such case my judgment is law. I am not conscious of having departed from any instructions which I have received. As to the propriety of the purchase and its public utility, no one can doubt. But if the Department's wish is to control the detail of purchases it must issue its Regulations before the purchases are made; otherwise it must pass the accounts.

"No act of mine has been more universally approved at this post than the cultivation of the shade trees—some of them have been set out this three years, but the man has not before called for his pay. They are its greatest ornament.

"I request, sir, that you will pass the account to my credit.

Very respectfully, I am, Sir,
Your Obdt. Servant,
(Signed) James Dalliba,
Late Major of Ordnance."

Lieut. Col. Geo. Bomford,
Ordnance Service.

The extent of the reservation was increased by the purchase of additional land in 1826. Still further parcels were acquired at various times until 1869. A small triangular plot was acquired in 1918 to make room for an extension to the seacoast cannon shop. This small plot of ground enclosed a cemetery which was an ancient burial ground for civilians of the village and also for the military of the arsenal. These remains were removed and those of the military reinterred in a small cemetary which was provided at the northeast corner of the arsenal grounds.

Commanding Officer's Quarters with Trophy Fountain in the Foreground, Watervliet Arsenal.

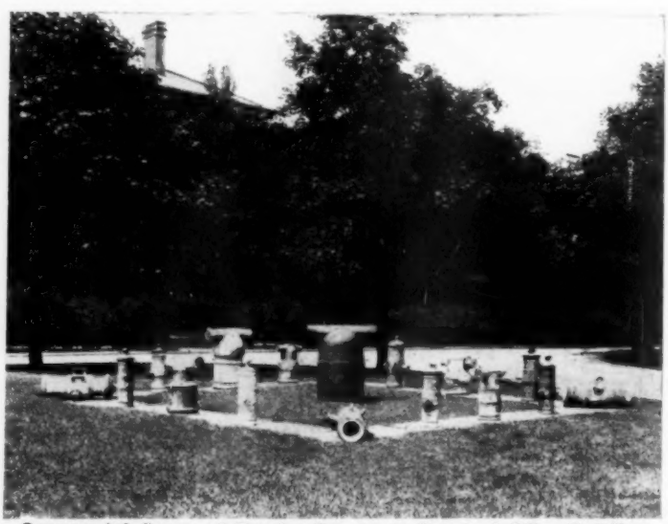
Under a special act of Congress, approved February 28, 1920, a plot of 32 acres in the City of Watervliet known as the "Arsenal Extension" was purchased for a proposed extension of the arsenal facilities. As the project for the further development of the arsenal was abandoned, this extension has since been disposed of so that the present reservation now covers an area of 108 acres.

Construction at the arsenal may be divided into six periods: 1813-17, when the original arsenal of twenty buildings was erected; 1826-30, when the stone arsenal

and the east magazine were built, the storage capacity considerably increased and additional shops erected; 1839-1850, when were built the commanding officer's quarters, a brick laboratory, a brick paint and harness shop, two brick carriage stores, two brick timber stores, a brick stable, two stone quarters for officers and one stone barracks for soldiers, a magazine for fixed ammunition and a wall along the river front; 1864-67, when shops and storehouses were extended to meet Civil War requirements; 1887-92, when the Army gun factory was established and the north and south wings of the seacoast cannon shop came into existence, and finally, 1917-20, when the great expansion for the World War took place.

View of Flower Garden with Officer's Quarters in the Background, Watervliet Arsenal.

Beginning with the first commanding officer, Major Dalliba, who had difficulties with his shade trees, the various commanding officers have continued his efforts towards beautifying the ground which rises gradually from the west to the Hudson River across the Erie Canal and now embraces a woodland which half conceals scores of immense shops and buildings amid the foliage of hundreds of shade trees. There are acres of greensward; there are paved thoroughfares; there are beautiful walks, shrubberies and fountains. There is a flower garden that is the envy of the student of horticulture, and it is difficult to reconcile the fact that the center of the cannon industry of the United States is located within the generously foliaged enclosure. Some of the interesting features that appeal to the eye of the visitor are the gate posts of stone with trophy cannon embedded in bas-relief, with other trophy guns mounted nearby, and the artillery park with its rows of trophy guns and mounds of round shot which replaces the old garden. In summer the park is ornamented with flower beds in various forms. The "Trophy Fountain" in front of the commanding officer's quarters attracts well deserved attention. Captured guns are placed about its base and the water issues from a pile of round shot with a center piece of art stone below. Many other interesting war trophies are found about the grounds: guns, mortars, howitzers and cohorn mortars. Some were captured at Saratoga, some at Vera Cruz and others at Santiago, most of them are of English, German or Spanish make. The grounds are given added military appearance by the high stone wall which encloses the entire reservation, with the exception of the east front which is separated from the main highway by an ornamental fence of iron pickets set in a stone foundation. This wall and fence were constructed during the first half of the last century, when labor and material were much cheaper, at a cost of approximately $150,000.



Ornamental Group of Trophy Cannon in Front of Office Building, Watervliet Arsenal.

The most famous of the trophy cannon is known as "The Lafayette Gun." On September 18, 1824, General Marie Joseph Paul Yves Roch Gilbert DuMotier Lafayette visited the Watervliet Arsenal and during the course of his inspection identified this gun.

"General Lafayette came up from Albany on an elegant canal packet boat, accompanied by another packet boat which was filled with both military and citizens from Albany and various parts of the State." Upon arrival at the Arsenal wharf, a salute of 13 guns was fired as the General disembarked. Lieut. Thomas J. Baird during the tour of the grounds told the General that he would introduce him to three of his old acquaintances and pointed to the English brass pieces of ordnance which were taken from Lord Cornwallis when his Lordship surrendered to the American and French Armies at Yorktown in 1781. Immediately he recognized one of these pieces by a deep indentation in its side where it had been struck by a cannon ball just previous to its capture. He embraced the gun and declared that it was a companion of his youth. On the occasion of Lafayette's death a few years later this piece was used in firing a salute in memory of the French hero who had done so much for American Independence.

At its inception in 1813 Watervliet Arsenal was the principal establishment for making fixed ammunition and small articles of equipment for a train of artillery. There were similar depots at Buffalo,

Seacoast Cannon Shop, Watervliet Arsenal.

Rome and Batavia, Major Dalliba being in command of all and assigning some one to superintend each depot. Ammunition included wooden shell, fuzes, wooden shot bottoms (sabots), paper cartridges, etc. Gun carriages were also fashioned at Watervliet Arsenal and in 1821 the "reparation and preservation of small arms" was of paramount importance. From then on similar work, also work in leather goods, harness, saddlery, etc., the manufacture of armament chests, gun carriages, percussion caps, horse brushes, curry combs, cartridge bags, etc., were carried on until the establishment of the Army gun factory at Watervliet in 1887.

The period of the Mexican War was an occasion for unusual activity, more than 500 employees being at work during this period.

During the Civil War, the manufacture of ammunition and the distribution of supplies reached a high mark. The shops and the storehouses were greatly extended to meet the military requirements. During this period the number of employees at times exceeded 2,000.

Shortly after the establishment of the gun factory the work on gun carriages, harness, saddlery, etc., was transferred to the Rock Island Arsenal, Illinois, and elsewhere. The foundry, in which castings for heavy projectiles were made, was also closed in the early nineties and the manufacturing work at the arsenal was exclusively of guns and their various parts.

Prior to 1887 most of the cannon used by the Army had been built in private plants. These were cast iron or cast bronze, principally muzzle loaders and the work was done at some of the large foundries in the country. With the advance in the art of steel making and with the higher physical qualities of steel forgings came the design of the breech-loading built-up steel cannon. For this highly specialized work there was no commercial parallel and no equipment in private industry suitable for its production.

To provide for the manufacture of this new and improved type of cannon it was proposed to erect a government establishment and in 1883 Congress passed an act, approved March 3rd of that same year, directing the appointment of a commission to recommend a site for the establishment of a Federal Gun Factory. This commission in a report dated February 16, 1884, after considering a number of sites recommended the selection of Watervliet Arsenal for this purpose. Due to the failure of Congress to make appropriations to inaugurate this project no further action was taken at that time.

In 1887 a board of Ordnance officers was appointed by the Secretary of War to consider and report upon the relative merits of Frankford Arsenal and the Watervliet Arsenal for this proposed gun factory. The board was composed of Lt. Col. D. W. Flagler, Lt. Col. Alfred Mordecai, Lt. Col. Francis H. Parker and Capt. Rogers Birnie, Jr., as recorder. In this report the board favored the Watervliet Arsenal for reasons which may be set forth briefly as follows:

It is situated at the navigable head waters of the Hudson River, 150 miles from the Atlantic seaboard and 185 miles from the Canadian border.

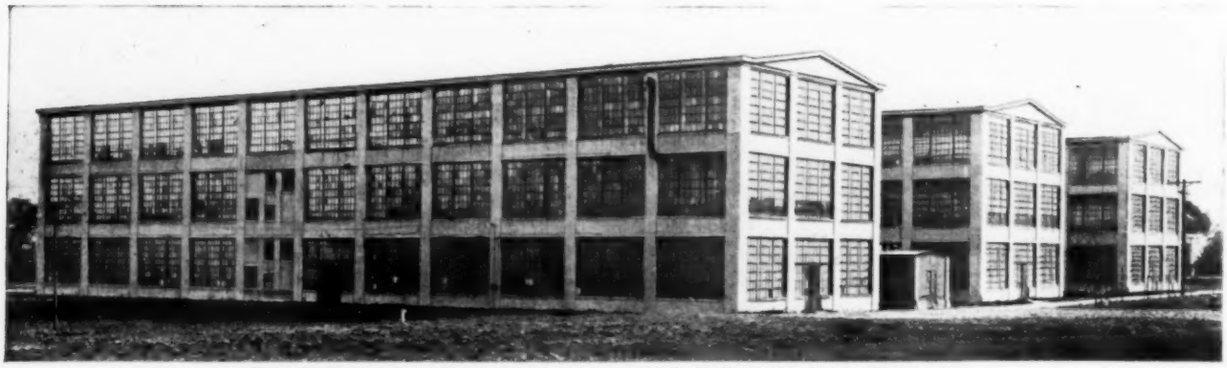
It is surrounded by, and within a radius of 5 miles are, the cities of Albany, Troy and Cohoes and the villages of Waterford and Green Island, and it is within 14 miles of the City of Schenectady.

It is situated at the terminal of five railroad trunk lines, viz.: the New York Central and Hudson River, the Delaware and Hudson, the Boston and Albany, the Boston and Maine and the West Shore railroads and is directly at the terminus of the Erie and the Champlain barge canals.

Its strategic value is thus established and its communication by rail with all parts of the United States, its connection by the Barge Canal and Great Lakes to Canada and by the Hudson River to the seaboard gives to it an economic value that is unsurpassed for the receipt of raw materials and for the shipment of its products.

Because of its location in this thickly settled section which has a highly skilled industrial

Assistant Officers' Quarters, Watervliet Arsenal.



**Breech Mechanism Shop, Watervliet Arsenal, Built During the World War.**

population and its easy access by trolley lines it has an excellent labor market.

With the approval of this report the actual construction of the gun plant was undertaken. Work was started on October 18, 1887, and the present seacoast cannon shop was completed and in operation on October 18, 1890.

The actual manufacture of cannon was begun before these new buildings were completed, in a structure formerly used for the storage of lumber. The equipment for this shop which was all of a special nature was acquired largely by transfer from other plants where some work in the manufacture of cannon had been done. These machines came from the West Point Foundry at Cold Springs, N. Y., the Watertown Arsenal, Watertown, Mass., the South Boston Iron Foundry Company, Boston, Mass., and the Springfield Armory, Springfield, Mass. A nucleus of trained personnel was also recruited from these same sources. In this temporary shop, facilities for handling heavy gun material were quite inadequate, nevertheless, initial manufacturing operations were started on a 10-inch breech-loading rifle which was completed in two and one-half years.

The gun factory as erected between 1887 and 1890 and its equipment as originally installed was with some slight changes, improvements and additions to the gun lathes and other machine tools, practically the same until the period 1915 to 1917. During these years, owing to the increase in the caliber, weight and length of heavy cannon it became necessary to increase the depth of the shrink pit and its overhead clearance, lengthen a number of the original gun lathes, purchase some new and larger equipment and extend the south wing of the gun shop and also increase its width to accommodate these longer lathes.

The seacoast cannon shop with its various expansions is approximately 1,300 ft. in length, varying in width from 125 ft. to 204 ft. and has a ground floor area of more than 200,000 sq. ft.

During the period of the Spanish-American War, in 1898, the Arsenal was unusually busy. During that period there were manufactured at the gun factory, some 190 cannon of all types from the 3.2-inch field guns, Model 1890, to the 12-inch B. L. rifles, Model 1895, together with a number of experimental guns. In addition the arsenal during this time was engaged in the preparation of ammunition and during the peak of production 2,000 field shell were filled, packed and shipped each day. The powder charges for this ammunition also were put up at the arsenal, although no special facilities for this work were in existence.

Up to this period in the history of the arsenal a number of additional buildings had been erected, including coal sheds, water tower, additional officers' quarters, hospital, greenhouse and a stock room. Briefly up to 1913 when the arsenal was a century old, there had been erected 87 buildings of which approximately 60 had been destroyed and 30 remained standing. These buildings had cost a total of approximately $1,400,000. The value of those remaining at the beginning of the World War was approximately $630,000.

With the declaration of war by the United States on April 6, 1917, began a period of unprecedented activity at the establishment. A building program of more than $4,000,000 was inaugurated. This was supplemented by the installation of machinery, railroads and equipment, costing about $12,000,000 additional, under a program which when completed would have employed 10,000 persons had the war continued until the spring of 1919. The buildings were all completed and the machinery and equipment ordered and much of it delivered and installed but at the time of the Armistice the operations of the plant had called for a maximum force of only 5,000 employees.

During the period April, 1917, to June, 1919, the total expenditures at the Watervliet Arsenal exceeded $25,350,000.

In the 19 months between the declaration of war and signing the Armistice the plant had been enlarged and nearly equipped for the manufacture of light and heavy mobile artillery in quantity. An immense shop had been erected for the manufacture of liners for cannon and the

**Part of the Old Arsenal Now Used as Field Service Storehouse.**

physical plant was ready for its full quantity production.

This expansion involved not only the construction and equipment of vast shops but the usual amount of incidental labor. The water supply was inadequate and a pump house was built and equipped and the mains extended. Additional sewers were laid and roads were paved. Terminal facilities were inadequate and tracks were laid so that both steam and electric motive power could bring cars, not only to the center of the grounds but into the various shops. Additional facilities for light and power, expansion of the telephone equipment and an enormous increase in the storage capacity at the arsenal were also necessary.

Cantonments were erected to house the increased number of enlisted men as all of this vast expansion necessitated additional soldiers and provisions for the training of the military as well as the new civilian employees. At one period there were on duty at the arsenal not less than 87 officers and 800 enlisted men.

With the signing of the Armistice all immediate necessity for the enormous output from this plant ceased. But like any machine which has acquired this tremendous momentum it could not be brought at once to a stand-still. In fact, this process was in many ways more difficult than that of building it up. New policies had to be adopted in Washington and during the first few years after the Armistice these policies were being changed and revised continually, each change and each revision always tending to a reduction in the activities to be continued at the permanent establishments. Work had been stopped in all of the private plants engaged in the manufacture of cannon. In these plants the Government had enormous interests and immense amounts of material, some finished, some partially finished and some in the raw state.

Eventually the manufacturing program was cut off at a definite point, material finished and partly finished beyond this limit was put aside as a possible reserve. Employees were laid off, wages were reduced and as these outside plants gradually liquidated their Government obligations, large quantities of machinery and machine equipment and materials pertaining to the manufacture of cannon were shipped into Watervliet Arsenal to add to the almost staggering amount which from the reduction of its own activities was already encumbering the buildings and all available ground.

All peace-time manufacturing activities were again concentrated in the old gun plant, consisting of the seacoast cannon shop and the adjoining breech mechanism department. The large new shops with their equipment most of it set up for operation were rearranged, cleaned out of surplus materials and put in standby condition. The task of disposing of the surplus property was undertaken and pushed as rapidly as possible.

At the present time the arsenal is operating with the smallest force in its history since the gun plant was established. Every bit of surplus and excess material for disposal has been sold and removed from the plant.

After this enormous expansion of plant and facilities during the World War the arsenal is left with an investment very much heavier than at any time in its history. The first parcel of land, twelve acres, cost $2,585.00. The total cost of the land excluding the "Arsenal Extension," which has since been disposed of, was $54,842.83. The present estimated value of the land is $590,000.00, improvements $1,582,000.00, buildings $5,686,500.00, equipment $9,476,437.50, or a total of $17,334,937.50. The value of the manufacturing stores on hand is $8,466,883.00 and the field service stores $7,146,840.77, or a total of $15,613,723.77.

The utilities include two and one-half miles of paved roads, one mile of macadam road, one mile of unimproved road, three and one-half miles standard gage railroad, 11.22 miles of sewer and water lines and 800 feet of docks.

Prior to the World War no definite plans had ever been made for the production of the arms, ammunition, equipment and all the innumerable items required for clothing, housing, subsisting and arming a volunteer army in case of an emergency. The necessity for such plans both from a military and economic standpoint were very apparent after the experience of this war. Based upon the provisions of the National Defence Act of 1920 plans for the national defense and for such military and industrial preparedness as can be made in time of peace have been prepared and are rapidly becoming perfected.

The Watervliet Arsenal is principally concerned in the plans for industrial preparedness. In its World War development, as will have been observed, the enormous expansion of this plant was not completed nor had any appreciable amount of its product been placed in the hands of troops before that conflict was terminated.

During this war period additional plants for the manufacture of cannon had been established as follows: At the Rochester Gun Plant, Rochester, N. Y., the Erie Howitzer Plant, Erie, Pa., the Northwestern Ordnance Company, Madison, Wis., and the Wisconsin Gun Company, Milwaukee, Wis. Each of these plants, of necessity, had turned out even less of its products than had the Watervliet Arsenal.

Under this new plan the total war requirements in the way of cannon have been determined and of this amount the Watervliet Arsenal has been assigned as many guns of various calibers as its existing plant can produce. The balance to make up the full quota has been assigned to other commercial establishments best equipped for handling this particular class of work.

The Watervliet Arsenal, therefore, has prepared its war plans for utilizing its full capacity and these plans are so well advanced and in such minute detail that with the material now on hand the actual work could be started at a day's notice, should the emergency arise. The arsenal is also assisting these other plants which have accepted allocations for the manufacture of cannon to prepare their own factory plans so that they will be ready on short notice to start production.

This establishment has been selected as the center of the cannon gage activities and assembled there are all of the existing gages for the production of the types covered by the war plans. These gages are all carefully inspected, checked and protected against rust and exposure and stored for immediate use or issue to these other plants when needed.

The small number of skilled mechanics now employed in the gun plant will be used as a nucleus for expanding this establishment and training its largely increased personnel and will also be called upon to supply a certain number of experienced employees to be used for the same purpose at those private manufacturing establishments where cannon will be manufactured in time of war.

# WATERVLIET ARSENAL ORGANIZATION CHART

COLONEL E. D. BRICKER

**COMM'D'G. OFFICER**
Col E D Bricker — Ord Dept
Col "Regular"
Lt. Col. – Not assigned

**834th ORDNANCE CO (DEPOT)**
(Capt. H. R. Wilson)
1st Lieut. – Not assigned
1st Lieut. – Not assigned
(2nd Lieut. Wm S. Weikel)
2nd Lieut. – Not assigned
2nd Lieut – Not assigned

**19th ORDNANCE CO (MAINT.)**
2nd Lieut. E. H. Clouser, Ord. Dept.
Capt. – Not assigned
(1st Lieut. V. Muller)
(1st Lieut. – R. L. Hoadley)
1st Lieut. – Not assigned
(2nd Lieut. S. J. Alling)
(2nd Lieut. J. B. Holmes)
(2nd Lieut. K. G. Burroughs)

**ADMINISTRATION DIV.**
Maj. Oscar Krupp, Ord. Dept.
Maj. "Regular"
Capt. – Not assigned
G. J. Ball.

**MILITARY DEPT.**
Capt – Not assigned
1st Lt – Not assigned
1st Lt. – Not assigned
(2nd Lt. C. A. Martin)

**MEDICAL DEPT.**
Maj. F. J. Noonan
1st Lt. – Not assigned

**PROPERTY DIV.**
Capt – Not assigned
H. R. Wilson, W.O.

**ALLOT. & COST DIV.**
Capt. – Not assigned
J. M. Flood, Jr.

**FINANCE DEPT.**
Capt. T. W. Conrad, Ord. Dept.
Capt. – Not assigned
L. H. Loadwick

**INSPECT. DEPT.**
Lt. Col – Not assigned
(Capt K. M. Cunningham)
S. E. Hammersley
W. H. Roblin

**SCHOOLS DEPT.**
Capt – "Regular"
J. P. Dorney

**ORDNANCE ENG. DIV.**
Major – Not assigned
(Capt P. L. Alger)
P. A. Horn
C. T. Kohler

**MET. & PHYS. LAB.**
(2nd Lt. E. H. Strunk)
J. D. De Voge

**CENTRAL PLAN.**
Major, – Not assigned
(2nd Lt. R. A. Dewey)
J. P. Kilmer

Major B. Dudley, Jr.

**WORKS MANAGER**
(Maj. Boyd Dudley Jr.)
Capt. – Not assigned
Oscar Olson

**GAUGE DEPT.**
Capt. – Not assigned
L. W. Dwyer

**PLANT ENG. DIV.**
(Maj. J. S. Smyser)
1st Lt. – Not assigned
C. T. Darr

**INDUSTRIAL DEPT.**
(2nd Lt. W. A. Stevenson)
E. W. Hinchliffe

**SAFETY ENG. DIV.**
(2nd Lt. B. G. Morris)
F. Leland

**PROCURE. DIV.**
(2nd Lt. V. G. Engleman)
A. B. Carpenter

**STORES DIV.**
(2nd Lt. W. A. Lee)
O. C. Toffe

**HEAVY FIELD CAN.**
(Maj. F. G. Spencer)
1st Lt. – Not assigned
J. H. Reineck

**LIGHT FIELD CAN.**
Major – Not assigned
(1st Lt. – R. W. Sellew)
W. L. Huxtable

**SEA-COAST CAN.**
(Maj. R. Cockburn)
1st Lt. – Not assigned
A. C. Munz

**BREECH MECH.**
(Maj. J. L. Hughes)
1st Lt. – Not assigned
E. J. Seamans

OSCAR OLSON

**FORGE SHOP**
2nd Lt. – Not assigned

**TOOL DEPT.**
(2nd Lt C Jacox)
T. J. Hickey

**CARPENTER SHOP**
1st Lt – Not assigned
J. Pullan.

**HEAT-TREAT. DEPT.**
1st Lt. – Not assigned
F. W. Drake

**BRASS FOUNDRY**
2nd Lt – Not assigned

Note:– Reserve Officers shown in parentheses in present assignment.

# The Reserve Officer

## *His Place in the Peace and War Organization of Watervliet Arsenal*

Maj. E. P. King, Ord. Res., U. S. A.

EACH attempt to bring about a closer relationship between the reserve officer and the permanent personnel in the regular establishment has met with gratifying success. Ordnance reserve officers, regardless of their geographical locations, are encouraged in this respect to maintain personal contact with their place of assignment, such as a permanent manufacturing arsenal or an ordnance district. This can best be accomplished by an occasional visit where practicable, attendance at ordnance meetings or illustrated lectures where design and development of the latest types of ordnance are shown or discussed, and by short periods of active duty training, at least one period of which should be at his place of assignment or "home station" provided it is a manufacturing arsenal. Another and very efficient means for training is the correspondence course work which is now applicable and available for all grades and assignments and which all officers are urged to take up wherever practicable. This training is especially valuable for those officers whose civil duties are of such a nature that they are denied the privilege of active duty training. Still another method of maintaining contact, which is now practiced by several of the corps areas, ordnance districts and arsenals, is by means of a bulletin which is issued periodically to each officer of the organization.

The latter method of maintaining contact was inaugurated by Watervliet Arsenal in February, 1926, and has been continued monthly since that time. This bulletin which is published in mimeograph form is prepared as a local issue in that its mailing list is principally confined to reserve officers who are either assigned to this arsenal for duty or who are assigned to ordnance companies to be recruited or trained at this arsenal. Its contents, therefore, are primarily confined to local activities, except that an effort is made to follow the progress of ordnance design and development and such legislative and administrative regulations as may affect the individual officer or the Officers' Reserve Corps in general. An organization chart which is issued as an addendum to the above also keeps each officer informed of his place of assignment within the organization and the relative grade that it is possible for him to reach in that assignment.

The relationship of the reserve officer to the permanent personnel of a manufacturing arsenal is indicated graphically in the organization chart of Watervliet Arsenal which is shown on the opposite page.

The war organization of the arsenal and its attached ordnance companies requires a total commissioned personnel of 56. The arsenal organization, exclusive of companies, requires a total of 43 of which three are regular army, four detailed from other branches and thirty-six ordnance reserve. Sixteen of the latter are now assigned and there are 20 existing vacancies.

The above organization, together with the personnel already assigned, is shown by grade as follows:

*Organization*

| | |
|---|---|
| Lieutenant Colonels | 4 |
| Majors | 6 |
| Captains | 12 |
| 1st Lieutenants | 9 |
| 2nd Lieutenants | 5 |
| Total | 36 |

*Officers at Present Assigned*

| | |
|---|---|
| Majors | 5 |
| Captains | 2 |
| 1st Lieutenant | 1 |
| 2nd Lieutenants | 8 |
| Total | 16 |

It is the experience of this arsenal that the personnel of the Officers' Reserve Corps is not unlike the personnel of a commercial organization in that an opportunity for promotion or advance in grade is always an added incentive for greater effort. Based on that experience the allotment of grades shown above has been so distributed that all officers are afforded ample opportunity for promotion.

The principal war mission of the Watervliet Arsenal, which is representative of all the manufacturing arsenals, is production of matériel and training of personnel.

The war plan of this arsenal provides for these functions in detail and for the conversion of the establishment, in event of emergency, from a peace to a war basis. As this arsenal is the only government establishment that is fullly equipped and at present engaged in the manufacture of mobile cannon, emergency production would be confined to like matériel. Tentative war orders, based on the requirements of the service and arsenal capacity, specify the type and caliber together with the dates of delivery. Tables of organization, shop layouts of facilities, operation lists and operation drawings and lists of war reserve material are a few of the major items contained in the war plan which would be of material assistance in placing that establishment on a war basis.

The successful accomplishment of the war mission of this arsenal, however, must necessarily depend to a large extent on the type of commissioned personnel assigned to the supervisory or key positions of this establishment at the outbreak of such emergency. The selection and assignment of the present reserve officer personnel, therefore, were based in each instance upon the officer's previous experience and known qualifications and have been followed insofar as practicable in each instance by such individual training as would best qualify him for the responsibilities incident to his assignment.

While the organization of this arsenal as regards commissioned personnel is somewhat less than 50 per cent. com-

plete, it has been particularly fortunate in that all of the senior and several of the junior officers have had World War experience similar to that to which they are assigned and several of these officers obtained such experience at this arsenal. As a result of the above, all of the major manufacturing departments will be under the immediate supervision of officers who are not only familiar with the methods of manufacture employed in that particular department but also familiar in general with the permanent civilian personnel around which he must build his emergency organization.

It must be realized, however, that types of matériel and methods of manufacture are constantly undergoing such changes that the reserve officer who is assigned to an arsenal and does not keep in touch with the duties of his assignment will lessen correspondingly his value to that organization. This does not mean necessarily that such contact should interfere materially with his civil duties but rather that he should adopt such means of inactive duty training as appear best suited to his assignment and which offer a minimum of conflict with his civilian pursuits. One method of inactive duty training that is applicable here is by means of meetings. Watervliet Arsenal inaugurated this method sometime ago and the results obtained to date, as indicated by attendance and interest displayed, have been very satisfactory. These meetings are held locally, at stated periods, and the meeting proper is held in the evening. All officers, however, are extended an invitation to visit the arsenal during the afternoon for the purpose of observing certain operations that may be in progress in connection with gun manufacture. The evening program in general is based on ordnance subjects and is usually featured as follows: remarks by the commanding officer of the arsenal; an illustrated lecture by some officer of the regular army and a series of moving pictures.

The statement previously made that each officer should have at least one period of active duty training at his "home station" is especially applicable to a manufacturing arsenal in that he is thus enabled to obtain a basic knowledge of the administrative and executive duties incident to the conversion of the establishment from a peace to a war basis.

Periods of active duty training for Ordnance reserve officers are now limited, in general, to fourteen days each and the courses are classified as basic and advanced. The basic courses are conducted at Aberdeen Proving Ground and Rock Island Arsenal and the advanced courses at each of the other manufacturing arsenals.

The basic course, as the name implies, is intended as the initial course and the advanced courses are so prepared that it is possible for each officer to select such training as most nearly corresponds to the duties of his assignment.

The training schedules for basic courses are confined principally to military instruction and functioning of matériel, while the advanced courses are generally confined to administration and manufacture.

The value to be derived from a course of active duty training by the average reserve officer is difficult of appraisal except that the following extracts taken from personal reports of certain officers who completed the 1926 course at Watervliet Arsenal may be considered as proof that the results obtained were at least equal to the effort involved, viz.:

"Where the student desires to study gun design and manufacture in detail Watervliet Arsenal probably offers the best facilities of any place in the country for the following reasons:

(a) One can study blue prints in perfect quiet and everything is concentrated and may be obtained in a moment.

(b) In a very few steps one may inspect parts of these same guns and see them in process of manufacture and assembly."

* * * * * *

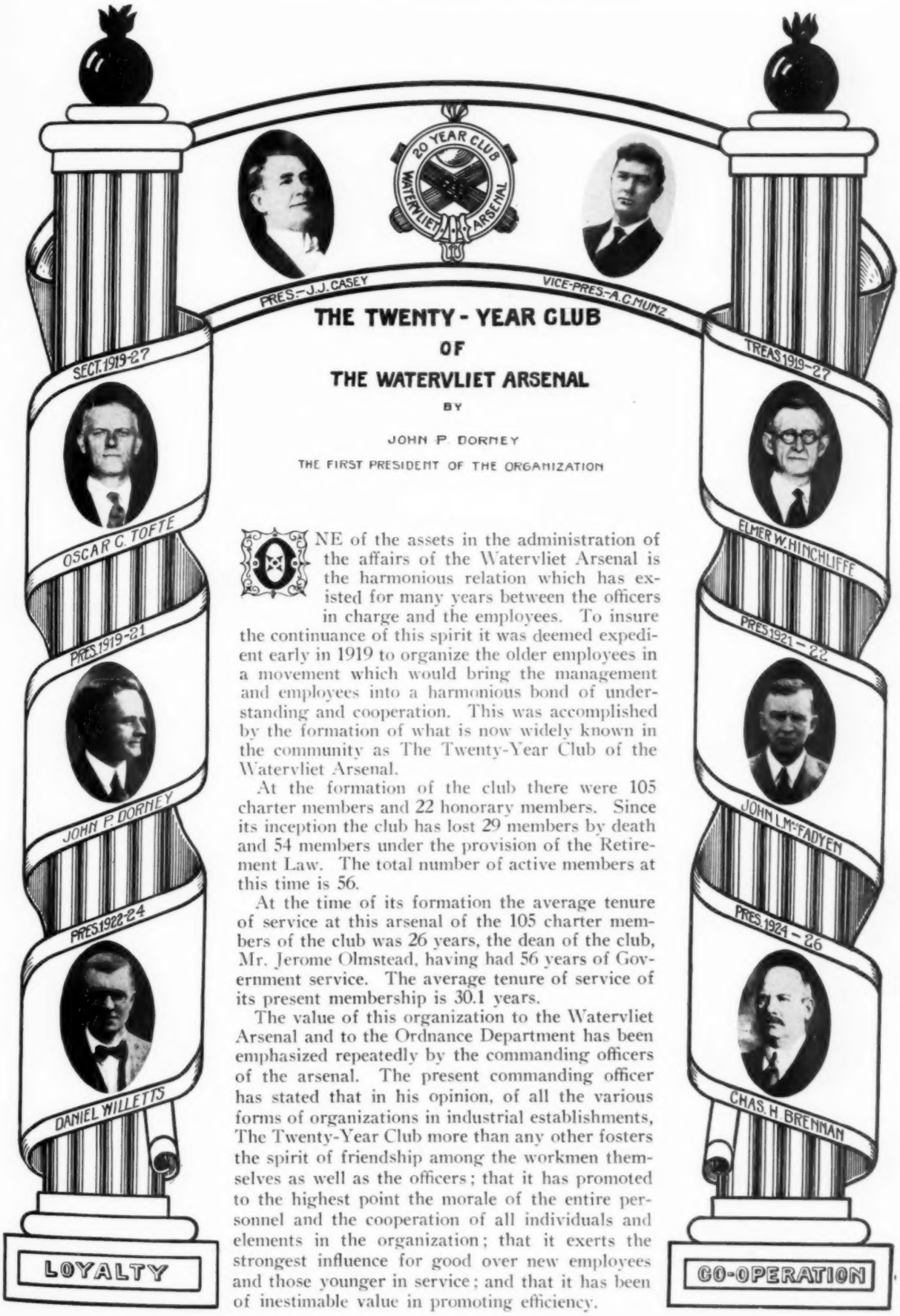
"Two of the most valuable results I have obtained are: (a) A keener and deeper appreciation of the mission of the Ordnance Department and the relations between it, the industrial war plans and the organized reserves. This cannot but obtain greater interest on my part as a reserve officer. The reserve officer who has had no active duty training often has but a moot idea of his connection with the general problem of national defense whereas a period spent in such a course as has just been completed clears the haze and places that connection on a definite and tangible basis.

(b) A clearer understanding of the problems of the Ordnance Department in war-time procurement and the necessity for a definite program laid down in advance, which incidentally serves as excellent material for combating the pacifist element."

While the above is but a brief outline of reserve officer activities at a manufacturing arsenal it is felt that such an organization, properly developed and trained and in constant touch with arsenal activities would prove of inestimable value in event of an emergency.

## Commanding Officers of Watervliet Arsenal 1816-1927

| | |
|---|---|
| Maj. James Dalliba | Nov. 14, 1816 |
| Maj. George Talcott | Sept. 21, 1824 |
| Lt. Col. W. J. Worth | Jan. 26, 1836 |
| Maj. R. L. Baker | Oct. 10, 1838 |
| Maj. J. Symington | Oct. 11, 1851 |
| Maj. A. Mordecai | June 23, 1857 |
| Maj. W. A. Thornton | May 15, 1861 |
| Col. P. V. Hagner | Dec. 25, 1863 |
| Maj. A. R. Buffington | Dec. 3, 1880 |
| Maj. A. Mordecai | Nov. 2, 1881 |
| Lt. Col. J. M. Whittemore | June 5, 1886 |
| Lt. Col. F. H. Parker | Nov. 21, 1889 |
| Maj. Isaac Arnold | Dec. 19, 1892 |
| Col. A. Mordecai | Feb. 23, 1898 |
| Col. J. P. Farley | May 26, 1899 |
| Lt. Col. Charles Shaler | Feb. 18, 1903 |
| Maj. D. M. Taylor | July 14, 1903 |
| Lt. Col. Ira MacNutt | May 1, 1905 |
| Lt. Col. W. W. Gibson | June 20, 1908 |
| Col. J. W. Munroe | Mar. 1, 1918 |
| Col. C. G. Mettler | Sept. 3, 1918 |
| Col. J. W. Benét | Mar. 11, 1919 |
| Lt. Col. W. I. Westervelt | June 1, 1921 |
| Col. E. D. Bricker | Oct. 1, 1923 |




# THE TWENTY-YEAR CLUB OF THE WATERVLIET ARSENAL

BY

JOHN P. DORNEY

THE FIRST PRESIDENT OF THE ORGANIZATION

ONE of the assets in the administration of the affairs of the Watervliet Arsenal is the harmonious relation which has existed for many years between the officers in charge and the employees. To insure the continuance of this spirit it was deemed expedient early in 1919 to organize the older employees in a movement which would bring the management and employees into a harmonious bond of understanding and cooperation. This was accomplished by the formation of what is now widely known in the community as The Twenty-Year Club of the Watervliet Arsenal.

At the formation of the club there were 105 charter members and 22 honorary members. Since its inception the club has lost 29 members by death and 54 members under the provision of the Retirement Law. The total number of active members at this time is 56.

At the time of its formation the average tenure of service at this arsenal of the 105 charter members of the club was 26 years, the dean of the club, Mr. Jerome Olmstead, having had 56 years of Government service. The average tenure of service of its present membership is 30.1 years.

The value of this organization to the Watervliet Arsenal and to the Ordnance Department has been emphasized repeatedly by the commanding officers of the arsenal. The present commanding officer has stated that in his opinion, of all the various forms of organizations in industrial establishments, The Twenty-Year Club more than any other fosters the spirit of friendship among the workmen themselves as well as the officers; that it has promoted to the highest point the morale of the entire personnel and the cooperation of all individuals and elements in the organization; that it exerts the strongest influence for good over new employees and those younger in service; and that it has been of inestimable value in promoting efficiency.

# The Buffalo Ordnance District

Capt. R. E. Hardy, Ord. Dept. U. S. A.*

THE National Defense Act of 1920 designates the Assistant Secretary of War, under the supervision of the Secretary of War, as the official charged with the control of policies affecting the business administration of the Army and, in Section 5a, defines his duties as follows: First to supervise the procurement of military supplies by the War Department; and second, to plan for the assurance of an adequate supply of all the necessary munitions in the event of an emergency.

In planning for the procurement of munitions in war, the office of the Assistant Secretary acts as a supervising and controlling agency. The operating agencies are the seven supply branches of the Army: Ordnance Department, Quartermaster Corps, Air Corps, Signal Corps, Chemical Warfare Service, Medical Corps and the Corps of Engineers. Cooperation with the Navy is obtained by means of the Army and Navy Munitions Board.

As it is estimated that government establishments have a capacity of only about 10 per cent. of total war requirements, it is necessary that the plans made by the supply branches provide for the manufacture of the remaining 90 per cent. by commercial plants. To eliminate duplication between the various supply branches, the Assistant Secretary of War allocates to each supply branch the industrial facilities with which it may deal. In special cases, joint allocations are made to two or more branches or to both the Army and Navy. These allocations are based on the recommendations of the branches concerned.

**Col. Ledyard Cogswell, Ord. Res., U. S. A.**
**Chief, Buffalo Ordnance District.**

For the decentralization of procurement by the several operating agencies in the event of war, the country has been divided into fourteen procurement districts shown on the accompanying map. Each supply branch has organized offices in such of these districts as it finds necessary. The Ordnance Department has found it necessary to establish headquarters in time of peace in each district.

The Buffalo Ordnance District, one of the operating agencies of the Ordnance Department, includes all of New York State north and west of Sullivan, Ulster, Green and Columbia Counties. This is practically the same territory as was included in the Rochester District of World War times. The district was established in November, 1923, by the appointment of Col. Ledyard Cogswell, Jr., Ord. Res., U. S. A., Albany, N. Y., as District Chief and the assignment of a regular Army officer as Executive Assistant. Headquarters have been established at the Watervliet Arsenal, Watervliet, N. Y., as this affords the district office all the advantages of being located on an ordnance post and being reasonably near the district chief permits him to keep in intimate touch with the district through the executive assistant. In the event of an emergency, the office would immediately move to Buffalo where the other branches have established their offices.

The district is exceptionally well situated with respect to transportation and power. The greatest concentration of industry is along the main line of the New York Central Railroad supplemented by the New York State Barge Canal and very extensive state highways. Many other railroads traverse the state, giving ample transportation facilities to even the smaller towns. New hydro-electric plants are being installed at various points, especially in the northern part of the district and the capacity is far in excess of that during the last war. The power systems from Buffalo to Albany are interconnected with each other and with the systems to the east and south. The St. Lawrence River on the northern boundary will add to the power resources of the district should the contemplated development become an accomplished fact.

Some of the products made by firms whose facilities could be converted to ordnance work are: electrical equipment, electric washing and ironing machines, heating devices, radiators, meters, typewriters, sporting rifles and shot guns, freight cars, air brakes, plumbing supplies, pumps, optical instruments, cans, machine tools, fireworks, etc.

*Executive Assistant to the Chief of the Buffalo Ordnance District, Watervliet Arsenal, Watervliet, N. Y.

At the present time 105 manufacturers are allocated to Ordnance in this district.

That these plans may be effective in war time, it is essential that industry be familiar with the drawings, specifications, and manufacturing information covering the articles to be produced by it in an emergency. It must also have made quite complete plans for producing these articles, procuring supplies such as raw material and machine tools, and also for procuring the trained labor. The sources of supply for secondary requirements should be selected with a view to regulation of transportation and priorities and with the idea of keeping war-time procurement along lines as close to normal business channels as possible. This will permit the most rapid and efficient transition from peace to war production and by allowing the continuance of customary business relations should facilitate the return to commercial work after the emergency is over. The manufacturer should be asked to plan for only such details as will involve a loss of time unless planned for in advance. He should be asked for definite estimates on definite articles and should be assured that he will be called on to produce these same articles in an emergency.

The first step is the determination of requirements by the Chief of Ordnance based on the needs of troops planned for by the General Staff and considering rates of wastage, rates of fire, stores on hand, and all other factors developed by past experience. These requirements are then apportioned to the field agencies in the form of a tentative apportionment. Each district reports to the Chief of Ordnance the amount of its apportionment which the manufacturers in that district can handle. This report is based on information obtained by the executive assistant during visits to the plants allocated. The Chief of Ordnance then issues accepted schedules of production to the district calling for a definite monthly schedule of production from that district. For instance, the Buffalo District has been issued accepted schedules of production for the following items: 75-mm. high explosive shell, complete rounds; 155-mm. high explosive shell, complete rounds; caliber .45 pistols; tank machine guns; aircraft machine guns; oilers; envelopes, fabric; machine gun covers; spare parts rolls; antiaircraft machine gun tripods; casemate mounts for 2.24-inch gun; 2.24-inch guns; panoramic sights; clinometers; azimuth instruments; rangefinders; field glasses.

Tentative apportionments for the following have been received: 3-inch trench mortar shell, high explosive, complete rounds; 4-inch trench mortar shell (smoke), complete rounds; 75-mm. shrapnel; 6-pounder canister; 30-pound fragmentation bomb; 100-pound demolition bomb; fragmentation hand grenade.

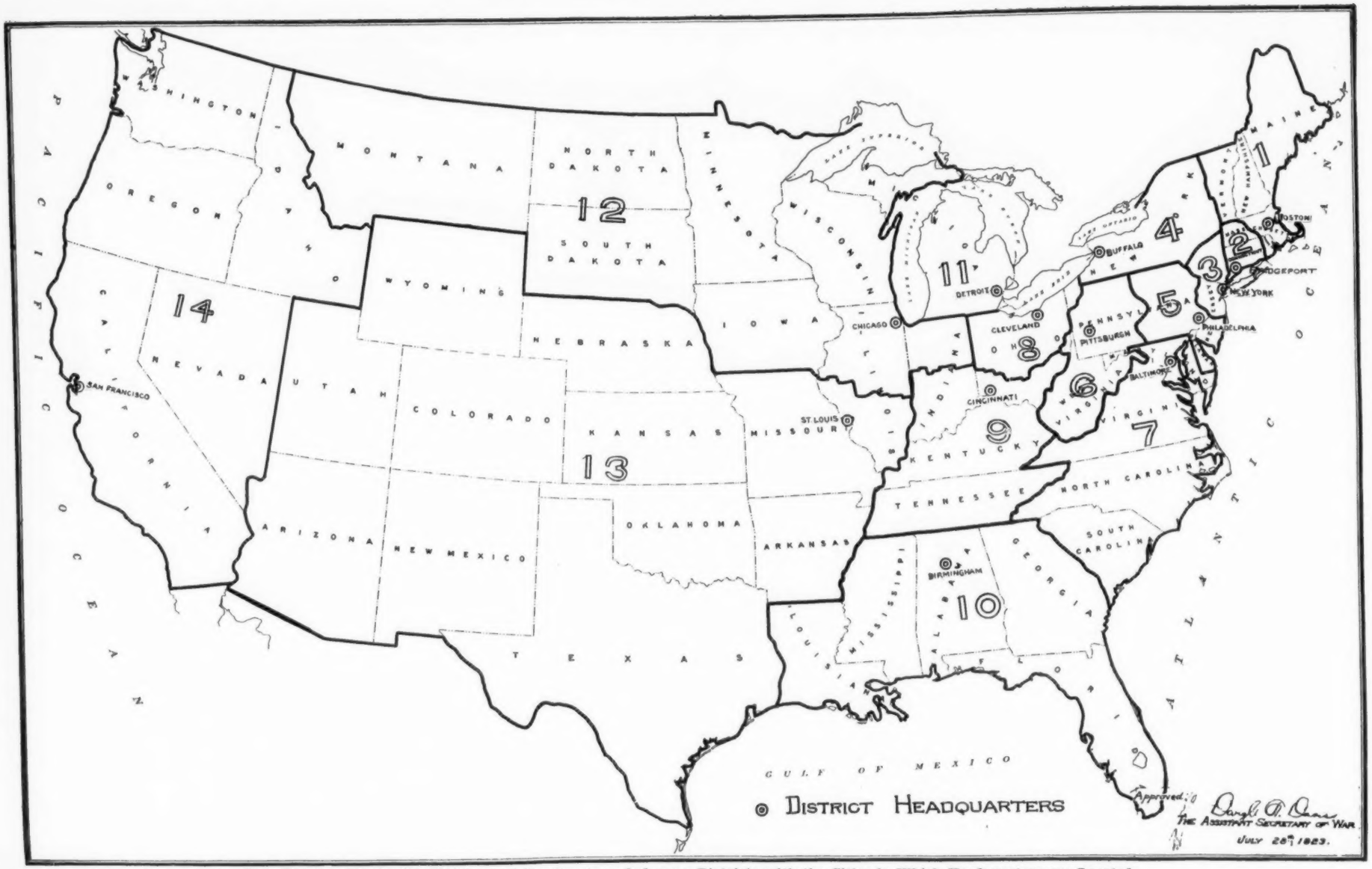
The weight of metal at maximum monthly production for the ammunition items alone for this district will be 23,900,000 pounds per month. The total estimated cost of the above items in the quantities required for two years will be $250,000,000.

Practically all the accepted schedules of production have been definitely placed with manufacturers who have been supplied with a copy of the order, complete set of drawings, complete set of specifications, and all the manufacturing information available. Most of these manufacturers are working on their factory plans and some have made extensive progress such as completing list of operations, lists of machine tools, bills of material, suggested sources of raw material, estimates as to requirements for labor, power, coal and oil, sketches of tools and dies. The requirements for machine tools, raw materials, etc., when furnished to the district office are placed with other firms as sub-procurement schedules and this method is carried out until the basic raw material is planned for or a point is reached where further planning is not necessary. In this manner, a schedule of production for a complete round becomes a large number of sub-procurement schedules for components, explosives, raw materials, shipping materials, etc., each one placed with a firm agreeable to the prime contractor and capable of producing the material called for.

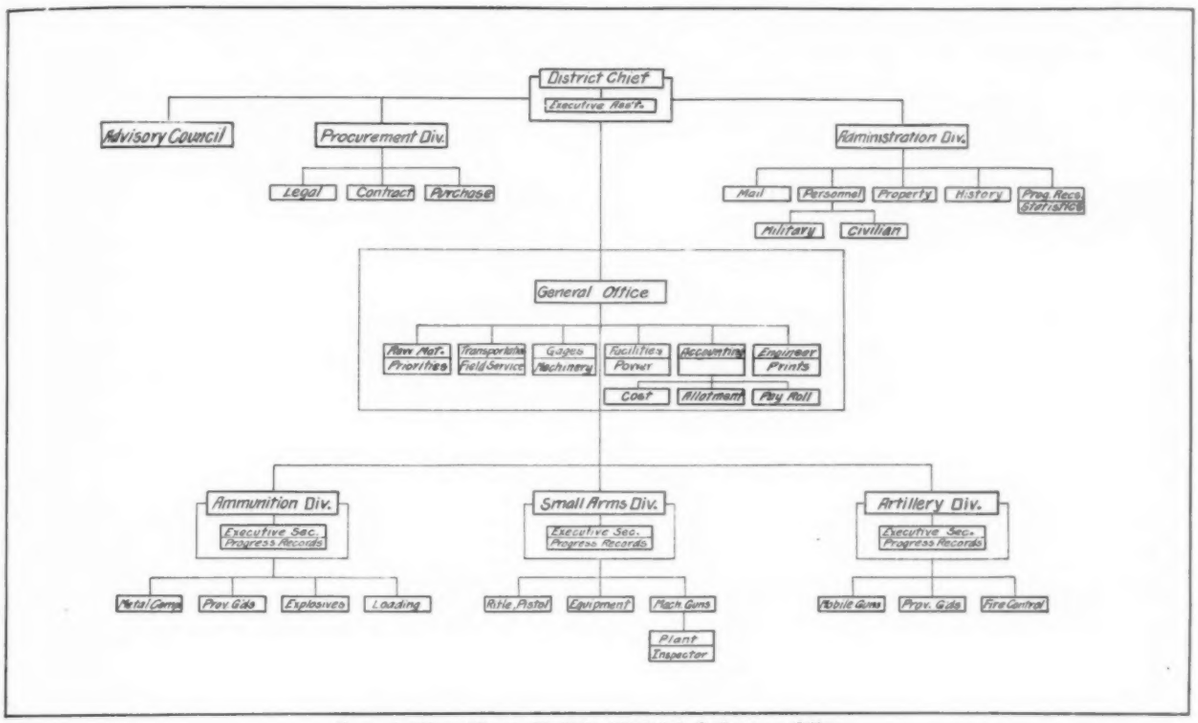
**Buffalo District Ordnance Office, Watervliet Arsenal, Watervliet, N. Y.**

Some of the manufacturers who had extensive experience during the World War have furnished complete information and drawings covering their methods of manufacture. These have been assembled, condensed and printed in booklet form for issue to any manufacturer desiring them as a guide or reference. In this way valuable experience is being put in the hands of those who will have charge of production during the next emergency. This alone is a very valuable step in preparedness, as otherwise this experience would be lost within a few years as the old war-time organizations disperse and the personnel pass on.

Several firms in the Buffalo District have sent representatives to government arsenals for the purpose of studying methods of manufacture and tests of the material for which they are making plans. The information obtained is used in making their factory plans and also is passed on to the personnel who in the event of an emergency would be responsible for the production of the particular articles. This is just one instance of the cooperation of manufacturers and an example of the seriousness with which factory plans are being made. Under such conditions, it is evident that these factory plans when completed will be exactly those which would have to be prepared by a manufacturer before starting production and which would usually entail a delay of several months if put off until the outbreak of an emergency. Having these plans made by the manufacturers' personnel and having a Regular Army officer continually on duty in each district, permits a fre-




Map Showing Territorial Divisions of the Fourteen Ordnance Districts with the Cities in Which Headquarters are Located.




**Organization Chart, Buffalo District Ordnance Office.**

quent check and revision of any arrangements made obsolete by changing conditions in business or in methods of manufacture.

Quite recently the executives of several concerns have recommended certain personnel for commissions as reserve officers with the view that they would receive two weeks' training at an arsenal every few years and thus be qualified to keep the factory plans fully up to date with developments in the Ordnance Department, as well as with changing conditions in their commercial business.

Other companies have offered suggestions as to new methods of manufacture based on the latest developments in their lines of business. In many cases they have experimented and made small quantities of ordnance material at their own expense, believing it their duty to assist their own government in keeping abreast of the latest improvements in manufacturing processes. Undoubtedly some of these experiments will revolutionize the process of manufacture of certain items of war material. When such experiments reach the stage where they indicate success, the Ordnance Department has been awarding small experimental orders with a view to developing the particular process and obtaining finished articles for test.

The War Department has been engaged in drawing up a contract for use in an emergency which will be acceptable to both the government and to the various contractors, will eliminate the objectionable features of contracts during the World War, and will assure every contractor a fair profit but without a chance to profiteer. The contract board forwarded the contracts to districts and other agencies for criticism by manufacturers. Various firms offered suggestions and constructive criticisms. One firm in this district appointed a committee which, after several months' study, drew up a contract embodying all its suggestions. The contract board then took all suggested revisions into consideration in drawing up the next contract. When the form of contract is approved finally, it should satisfy the majority of manufacturers as it will embody, as nearly as possible under the legal limits in effect at any time, the ideas of business men.

The following are a few of the larger plants in this district which have accepted schedules or otherwise cooperated with the district in planning for industrial preparedness: General Electric Company, American Car and Foundry Company, Remington Arms Corporation, Savage Arms Corporation, New York Air Brake Company, Bausch & Lomb Optical Company, Bossert Corporation, Crosby Company, Rome Brass and Copper Company, Rome Manufacturing Company, American LaFrance Fire Engine Company, American Brass Company, American Radiator Company, Emblem Manufacturing Company, Consolidated Car Heating Company, Automatic Transportation Company, Buffalo Meter Company, Buffalo Pressed Steel Company, Donner Steel Company, Eclipse Machine Company, Remington Typewriter Company, Gleason Works.

To carry out these plans in an emergency it will be necessary for the district to expand very rapidly by utilizing reserve officers trained in peace time both in general Ordnance training and in the duties of their particular wartime assignments. The district has therefore been organized on an emergency basis of 126 reserve officers and one regular Army officer as executive. The organization follows that of the Office of the Chief of Ordnance as closely as possible so that corresponding divisions in each may deal directly with each other. Of course, the industrial plants are under the supervision of the divisions which handle the material the respective plants are to produce. In addition, there is a procurement division to negotiate contracts, etc. Also an advisory council composed of a physicist and optical engineer, a metallurgist, a referee in the State Labor Department, a business executive and experienced gage man, all of whom have been commissioned.

It is planned to secure an industrial engineer to head this board of technical advisors to the district chief.

To date, 56 reserve officers have been secured and assigned to their respective places in the organization. The inspectors have been assigned to their plants. Each officer knows his assignment and at least has an outline of the function of his particular section. Seventy per cent. of the officers have had at least two weeks' active duty training at an arsenal, in the district, in the Office of the Chief of Ordnance, or in the Office of the Assistant Secretary of War. Many of them have had several periods of training at different arsenals, thus qualifying in the manufacture of various types of material and becoming capable of being the real head of one of the manufacturing divisions of the district. A few have taken special courses of training along special lines. A great many have taken and are taking correspondence courses and improving themselves as ordnance officers even when they are unable to take two weeks or more for active duty. Those living near the district office attend meetings at which ordnance subjects are the main feature usually presented by an officer from the Office of the Chief of Ordnance and illustrated by slides or moving pictures. All are kept in touch with district activities by bulletins issued about nine times a year.

Reserve officers have also cooperated in their respective civilian positions in assisting in the making of factory plans and in the development of new methods of manufacture. Their activities and interest are increasing as the organization grows. Promotion and reappointment depend upon their degree of interest and work. As the assignments below show, a large percentage of the officers in this district are recruited as second lieutenants and ample vacancies for promotion are available for those who earn it.

Reserve officers in the Buffalo District are assigned as follows:

*District Headquarters:* Col. Ledyard Cogswell, Jr.; Majors F. K. Richtmyer, Wm. H. Keen, C. K. Blatchly, Chas. E. Smart; Captains C. H. McKnight, M. H. Clark, Paul Tanner, R. J. Hannon; First Lieutenant W. B. Franke; Second Lieutenants: J. B. Stern, T. S. Hubbard, E. F. Searles, C. R. Webb, C. H. Churchill, L. C. Bennett, J. L. Davidson, C. M. Price, O. E. Zabel.

*Ammunition Division:* Majors C. F. Morley and E. P. King; Captains Wm. H. Boyer, J. F. Kruchten, Warner McLaughlin; First Lieutenants S. A. Smith, D. L. Rehlaender, G. B. Roth, J. H. F. Madgett; Second Lieutenants L. J. Ager, D. A. Reesor, D. A. Rogers, C. W. Lepsch, J. W. Sterrett, K. B. Castle.

*Small Arms Division:* Majors A. M. Platoff, H. A. Brown, J. Morgan; First Lieut. W. D. Bartlett; Second Lieutenants B. F. Titus, E. W. Hammond, W. G. Mollenberg, E. Posner, J. L. Hodgkins, A. E. Smith, R. C. Van Sickle.

*Artillery Division:* Capt. G. R. Brophy; First Lieut. S. S. Scott; Second Lieutenants R. J. Sloan, F. J. Mollerus, D. C. Lamb, A. W. Laird, A. J. Alaura, K. H. Jewett, D. D. Alexander, Loyd Colston, R. H. Sharp.

## Heroes of Picatinny Disaster Honored

SEVEN officers and enlisted men of the Army recently were awarded the Soldier's Medal for heroism in connection with the Lake Denmark Naval Ammunition Depot disaster, July 10, 1926. Those whose heroic work merited the Soldier's Medal, a new Army award, are Maj. N. F. Ramsey, Commanding Officer at Picatinny Arsenal at the time of the disaster, now stationed at the Command and General Staff School at Fort Leavenworth, Kan.; Maj. Herman H. Zornig, former chief of the Technical Division at Picatinny, now assistant Military Attaché at Berlin, Germany; Maj. Augustus L. L. Baker, M. C. Res., of Dover, N. J., contract surgeon at Picatinny; Capt. John P. Harris, chief of the Loading Department at Picatinny; Capt. Joel G. Holmes, former head of the Explosives Department at Picatinny, now Ordnance representative on the Coast Artillery Board at Fort Monroe, Va.; Technical Sergeant Christian J. Vogt, Ord. Dept.; and Staff Sergeant Arlie L. Downey, Finance Department, U. S. A.

The citations accompanying the awards were:

To Major Ramsey:

"For heroism on July 11, 1926, during the explosions at the Lake Denmark Naval Ammunition Depot, near Dover, New Jersey. Major Ramsey, in charge of a party of eight men, entered the burning area at 6:30 A. M. to search for First Lieutenant George W. Bott, Jr., United States Army, who was known to have been in the powder factory at the time of the first explosions late the preceding afternoon. Throughout the search they were in close proximity to burning magazines, and exposed to frequent explosions of large caliber shells and small arms ammunition. While there was still possibility of more serious detonations and at the risk of their lives they located the body of Lieutenant Bott, and with great difficulty succeeded in removing it from the wreckage to a point outside the danger zone."

Similar citations accompanied the awards to Major Zornig, Captain Harris, Captain Holmes and Sergeant Vogt who were members of the rescue party led by Major Ramsey.

To Major Baker:

"For heroism on July 10, 1926, during the explosions at the Lake Denmark Naval Ammunition Depot, near Dover, New Jersey. Doctor Baker, the contract surgeon for Picatinny Arsenal, was in his office in Dover, N. J., when he felt the concussion of the first explosion and immediately left for the arsenal. Upon learning that an injured woman was lying in the road near the point where the two heaviest explosions had occurred, Doctor Baker, accompanied by two other men, proceeded toward that point. While there was probability of other serious detonations, they reached the injured woman, rendered first aid, and dispatched the patient to the hospital. The rescue was made at a time when there was a continuous roar of exploding magazines and when the air was filled with flying shells, stones and fragments of buildings, and was effected shortly before the third heavy explosion occurred."

To Sergeant Downey:

"For heroism on July 10, 1926, during the explosions at the Lake Denmark Naval Ammunition Depot, near Dover, New Jersey. Sergeant Downey upon learning that an injured woman was lying in the road near the point where the two heaviest explosions had occurred, accompanied by two other men, proceeded toward the point. While there was probability of other serious detonations they reached the injured woman, secured a litter and dispatched the patient to the hospital. The rescue was made at a time when there was a continuous roar of exploding magazines and when the air was filled with flying shells, stones and fragments of buildings, and was effected shortly before the third heavy explosion occurred."

16-inch Gun, 50 Caliber, Ready for Shipment from Watervliet Arsenal. A 75-mm. Field Gun in Foreground.

# Manufacture of Cannon at Watervliet Arsenal

## *Development of Modern Types and Production Methods*

Hugh Smith

PRIOR to the year 1887 all cannon in use by the United States Army had been manufactured by commercial concerns in privately owned plants. Following congressional action authorizing the establishment of modern seacoast defenses necessitating the manufacture of a large quantity of ordnance the Secretary of War, in March, 1887, instituted proceedings which led to the founding of a federal plant at Watervliet for the manufacture of cannon. An existing one-story brick building, 50 feet wide by 392 feet long, was immediately fitted up and equipped for a shop and manufacture commenced in October, 1887. The equipment, a large part of which was necessarily of a special type, was acquired partly by transfer from privately owned plants which had been engaged in producing similar matériel.

**HUGH SMITH**

**Foreman of Seacoast Cannon Shop at Watervliet Arsenal for past 35 years and one of the leading American authorities on cannon construction.**

These initial facilities were later greatly increased by erecting and equipping the large seacoast cannon shop. This shop was placed in operation in October, 1890. The principal type of cannon authorized for manufacture at that time, initial orders for which were placed with this arsenal, were as follows: One 3.2-inch field gun, Model 1890; two 8-inch rifles, Model 1888; three 12-inch rifles, Model 1888; four 12-inch mortars, Model 1890.

All these types were the result of recent development at that time and were a decided departure from similar matériel then in service which they were to replace, namely: the 3-inch wrought iron gun, the 8-inch converted Rodman gun and the 12-inch mortar, Model 1886 and 1886 MI.

The 3-inch wrought iron gun was constructed by wrapping boiler iron around a wrought iron mandril, heating the resulting cylinder to a welding heat and then passing it through rolls, after which it was bored, rifled and turned.

The 8-inch converted rifle was a modification of the 10-inch Rodman cast iron gun formerly in service, the object of conversion being to render them more accurate and powerful by changing them into rifled guns. This was done by boring out the original 10-inch bore to a somewhat larger diameter and inserting a tube which had been finish bored and rifled prior to its assembly.

The 12-inch mortars, Model 1886 and 1886 MI, were both of the breech-loading type and both were rifled. The 1886 model was of the single piece cast iron construction, the 1886 MI of similar construction with the addition of reinforcing steel bands or short hoops.

All modern guns of 3-inch caliber and above are of either "built-up" or "wire wrapped" construction with the exception of some experimental designs which are made of one piece tubes with or without loose liners. The manufacturing operations of the latter type are practically the same as those for the preceding models. A discussion of one type will, therefore, illustrate a typical manufacturing procedure for the construction of modern cannon.

The manufacture of a 14-inch .50 caliber breech-loading gun of the built-up type is considered representative of general practice. It will be understood, however, that the following discussion relates to the gun body only and will be confined to certain mechanical operations applicable to this class of manufacture only, namely: telltaling, rough and finish boring, step boring and taper boring the tube for the liner, finish boring of gun, step threading of breech recess and rifling. The subject of breech mechanism manufacture and shrinkage operations are discussed elsewhere in this issue.

### Telltaling

The first operation on all major forgings, upon receipt at the finishing plant, is the telltaling, the purpose of

**Interior of Seacoast Cannon Shop at Watervliet Arsenal Showing Completed and Partly Finished Guns.**

which is to determine that there is sufficient metal, properly distributed, to allow for machining to prescribed dimensions. The procedure is to place the forging in a lathe, one end held in the lathe chuck and the other end in a revolving rest, then by adjustment of the chuck and the revolving rest jaws cause the exterior of the forging to run true.

The telltale which is then introduced into the bore, consists of a light wooden beam, resembling a straight edge somewhat longer than the forging; it is trussed by taut wires from the center to both ends to obtain rigidity. It has a fulcrum pin sufficiently removed from the longitudinal center to obtain a slight preponderance on the outer or "reading" end. This pin is resting across the top edges of a long wooden trough or container which is mounted at proper elevation to permit the beam to pass through the bore of the forging. On the forward end of the beam, which operates in the bore, is a vertical steel point which is held in contact with the top element of the bore by the preponderance of the outer or rear end of the beam. Across the container at the outer end of the beam is a small moveable block to which is attached in a vertical position an ordinary machinist's scale. On the extreme rear end of the beam is fastened a sheet metal pointer which extends beyond the beam and rests against the flat side of the scale. When ready to commence the telltaling operation a zero or starting point is established on the forging and readings are taken at 90° apart on the circumference and at fixed distances throughout the length of the bore. For easy reference the four chuck jaws are generally marked 1-2-3-4 and No. 1 is taken as the zero or starting point. The first reading is now taken and recorded with No. 1 jaw at the top center and the point in contact with the bars. The rear end of the beam is then raised enough to free the point on the forward end from contact and the lathe rotated so as to bring No. 2 jaw to the top center, the rear end of the beam lowered and the second reading taken. Readings are thus taken at the four designated points on the circumference and the beam then moved forward, generally one foot, for the second set of readings.

From the above description it will be seen that any difference shown by the pointer on the scale at readings on stops 2, 3 and 4 from that shown at No. 1 represents the eccentricity of the bore at that point. Should there not be any difference between the four readings there is obviously no eccentricity.

When complete readings have been taken throughout the bore of the forging and the result indicates sufficient metal to cover any existing eccentricity or irregularity, spots of a prescribed width and diameter are turned on the exterior. These spots then become the basis of alignment for the subsequent boring. Should the irregularities shown by the readings be greater than the stock to be removed permits, it becomes necessary to readjust the position of the forging by means of the chuck and steady rest jaws and then again telltale.

In the case of scant stock and badly irregular bore it may be necessary to readjust the forging several times before a satisfactory setting is obtained. Very long forg-

ings, such as tubes and liners, have to be telltaled from both ends and must, therefore, be reversed in the chuck to complete the operation. Before reversing a very narrow spot is turned on each end of the forging removing only enough metal to round up; the forging is then reversed and adjusted to these spots. The method and purpose of telltaling has been described in considerable detail since, as far as known, no parallel exists in commercial machine shop practice.

### Boring

The term "rough boring" is really a misnomer when applied to a tube or a liner as the rough boring operation in these cases consists of one roughing and one finishing cut. The type of reamer or boring tool used to produce cylindrical bores is practically the same regardless of the size of bore, the finishing reamer—particularly for long bores—being generally somewhat longer than the roughing reamer which is sometimes termed a "hog-nose reamer." The body of the reamer is a flat cast iron or cast steel head of varying thickness according to the size of the head which terminates at one end in a taper shank for assembly to the boring bar. At the forward end of the head are two pockets or recesses in which the cutters are mounted. The cutters on the roughing reamer have the cutting edge on the extreme forward end of the cutter and at right angle to the axis of the bore.

The cutters on the finishing reamer have their cutting edge on the sides with a slight taper on the forward end for a gradual entry of the cut. Both types of reamers are lined with well seasoned, oil impregnated, hard maple blocks. These blocks are bolted to the flats of the reamer somewhat to the rear of the cutters and are then turned to a diameter slightly larger than that of the cutters. A good firm fit of the wood blocks in the bore is absolutely essential since this is practically all that controls the direction of the reamer.

When a forging has been prepared for boring, i. e., telltaled and spot turned, it is mounted in the boring lathe and held in the chuck at one end with the other end in a steady rest on the spot provided in the telltaling operation. It is then centered at the chuck end by the turned spot near that end and at the steady rest end by measuring the distance between the interior of the steady rest and the true spot on the forging, shifting the forging by means of the steady rest jaws until this distance is the same at all points on the circumference. It should be noted that all steady rests on boring lathes are bored true with the lathe spindle, each one on its respective lathe bed. In the case of long comparatively slender forgings it is necessary to provide several steady rests equi-distant apart to hold up the sag of the forging.

The free end of the forging is now counterbored for a depth of about four inches to the exact diameter of the reamer to be used. The reamer which is carefully keyed up into its socket in the bar is now slowly entered into the counterbore and again withdrawn in order to observe that neither one of the cutters is causing a score mark in the counterbored spot in the forging. If this is found to be the case the forging is shifted by the steady rest jaws until the counterbore is in exact alignment with the reamer. The readjustment required at this time is, if the preliminary set up has been properly carried out, only a matter of a few thousandths of an inch. The cut is now started and carried forward about an inch beyond the counterbore so that the reamer is surely working under its full load. The reamer is then withdrawn and the part cut by the reamer is checked for size; if found oversize the reamer cutters are honed-off and a second trial made until the exact size is obtained; seldom is more than one trial needed, however.

It should be noted that the honing-off remedy can only be resorted to on rough boring operations; when a finishing reamer does not cut the prescribed size on the first trial it must be relined.

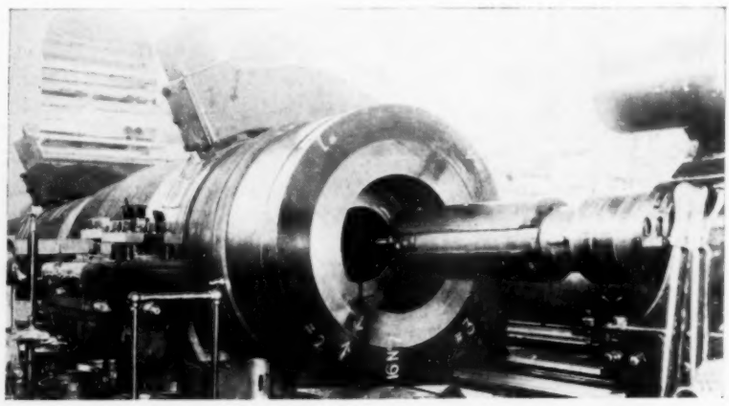
Oil is fed in large quantities to the reamer cutters at about 20 pounds pressure. Mineral lard oil is generally used on all boring operations. A cutting speed of about 16 to 18 feet per minute is used on the roughing reamer with a feed of .03 per revolution; however, as there are two cutters at work simultaneously the depth of cut is .015 per cutter. The second or finishing reamer is started in the same manner as the first one. This reamer, however, is run at a cutting speed of ten to twelve feet per minute with a feed of .08-inch to .10-inch per revolution.

The amount of enlargement made by the first reamer naturally depends upon the amount of stock left in the bore by the steel works. Sometimes this is irregular to such an extent that the width of the cut on one side in the bore may be 5/8-inch and on the other side barely enough to true up. The second or finishing reamer is always removing a definite amount of stock, generally .10-inch on the diameter. The inner tube or liner in a 14-inch gun is preliminary bored to 13.70 inches, using two reamers as described above before being turned for assembling in the gun. The finish or smoothness of this bore must be such as to permit stargage readings to be taken to within .0005-inch to check the compression obtained when the liner is assembled in the gun.

### Step Boring Main Tube

The bore of this forging, as received at the finishing plant, is composed of four cylindrical zones of diminishing diameters towards the muzzle end. When finally prepared for assembly of the liner this bore has been converted to four tapered zones each one of a lesser diameter towards the muzzle. Before this stage is reached there are, however, a great number of intervening operations, the first one of which is called "rough step boring." When prepared for and mounted in a boring lathe in the manner previously described with the rear or large end in the steady rest, the first zone is enlarged to a predetermined diameter by means of the usual roughing and finishing reamers. For boring the second or next smaller zone a roughing reamer is prepared in the usual manner with the wood liners turned to size. A number of narrow hard maple strips are then nailed longitudinally on the exterior of the reamer liners and these strips are then turned to fit the bore of the first zone. These strips will then serve to steady and align this reamer in the already machined larger zone when it is making its own start in the second zone. When the ends of the strips come in contact with the shoulder as the reamer proceeds into the bore the copper nails holding the strips to the main liners are sheared off and the strips are left behind in the larger bore. The finishing reamer for the

second zone is then prepared and started in the same manner. The third and fourth zones are machined in the same way with the following variations: the wood strips nailed to the third zone reamers are turned to fit the bore of the second zone. Since, however, the entrance to the second zone is about ten feet inside the end of the tube a considerable droop would take place in the boring bar if extended that distance from the nearest housing, particularly so with the weight of the reamer added at the end of the bar. To take care of this droop while the third zone reamer is passing through zone 1 and entering zone 2, following rings are provided on the bar in rear of the reamer. These rings are bored to a slip-fit on the bar and turned about .01-inch smaller than the bore in which they are to serve. When the third zone reamer is moved forward into zone 2 the following ring behind the reamer is pushed along with it, thus holding the reamer centered until the strips on the reamer liners enter zone 2. When boring the fourth, or muzzle zone, 2 sets of following rings have to be provided in order to carry the reamer through zones 1 and 2.



**A 16-inch Gun being "Finish Bored" at Watervliet Arsenal.**

After each roughing reamer the bore is telltaled to insure that no runout exists. Should the bore be found not true another roughing reamer has to be prepared of a size that will straighten out that zone with the smallest possible amount of enlargement, since any overboring at this time reduces the amount left in that zone for subsequent boring and reaming operations. A roughing reamer has to be used for the straightening operation before the finishing reamer can be used for the reason that finishing reamers, due to the shape of the cutters, have a tendency to follow the path prepared. The only necessity for a smooth finish in the four zones of the bore at this time is the fact that the compression produced in the bore by each hoop as it is assembled on the tube has to be checked and proved by star-gage measurements.

When the gun is completely built up, without the liner, the tube is again step bored preparatory to taper reaming the liner seat. The four existing zones are enlarged and the three shoulders carried forward at the same time sufficiently to leave just the right amount of stock at the rear of each shoulder for the taper reamers to clean up. Two reamers are used in each zone in this operation. The four zones which are now cylindrical, smooth, straight and concentric with one another are then split up into twelve shorter zones. This operation is done by reamers of a reverse type from those previously described in that the cutters are mounted on the rear end of the flat reamer head with the lined head serving as a pilot, the reamer being thus actually converted into a counterbore.

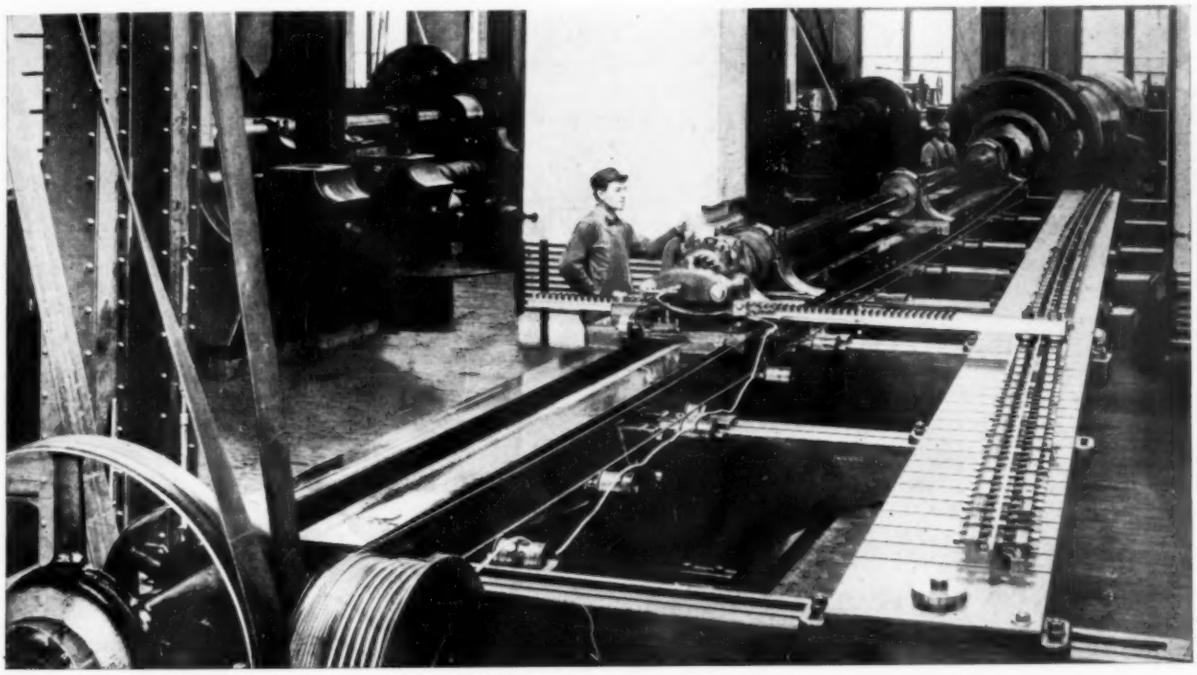
The forward, or fourth, zone is first enlarged by one of these counterboring reamers for about one-third of its length. A second reamer is then introduced into the fourth zone enlarging the middle section to a size halfway between the original bore of this zone and its first enlargment, the original fourth zone being now converted to three short zones with a stepdown in diameter of about .15-inch on each one. The three remaining original zones are then similarly converted to shorter zones and the bore is ready to taper ream the liner seat. It is, of course, obvious that all these step boring operations require the use of a number of following rings behind the various reamers as previously described in the "rough step boring" operation.

The reamers used in taper reaming the liner seat in a 14-inch gun are longer than those ordinarily used in cylindrical bores. Twelve reamers are used, varying from 53.00 inches to 63.00 inches in length, the total length of the seat being about 700 inches. The taper in the liner seat is .003-inch on the diameter per inch of length and the reamers naturally are made to conform to this taper. The reamer bodies are identical with those previously described except for the greater length, a short pilot carrier on the front end and the tapering diameter. A cutting blade, extending the full length of the reamer but made up in sections, is mounted along the edge on each side in pockets cut out in the body of the reamer. Impregnated maple blocks are bolted to the body, covering the full length and turned to the required taper. The pilot ring on the front of the reamer is turned to fit the cylindrical zone about to be taper reamed; the reamer is inserted and held central at the start by the pilot ring and by following rings behind the reamer. When the pilot approaches the shoulder of the next zone in front the reamer is withdrawn, the pilot ring removed, the reamer cleaned and honed if required and then fed home to the proper distance from the end of the tube. Each succeeding zone is then taper reamed in the same manner. Great care must be exercised in stopping each reamer the correct distance from the end of the tube. So closely is this done that visual inspection or measurements cannot detect where the cut of one reamer joins the adjacent one.

### Finish Boring Gun

This operation which is done after the assembly of the liner and is practically identical with the preliminary boring of the liner, except that at this time the bore must be—when completed—within .001-inch of prescribed size in addition to being smooth, straight, round and true with the axis of the gun. One roughing and one finishing reamer are used in this operation, both of the usual type except that they are about 12 inches longer. The gun is first mounted in the boring lathe with the breech end in the lathe chuck and the muzzle end in a steady rest, with two additional rests between to help carry the weight and prevent any sagging. The roughing reamer is then advanced about half way through the gun after which

the gun is reversed in the lathe and the roughing reamer is run through from the breech end to meet the cut started from the muzzle end. The finishing cut is then taken, starting the reamer from the breech end and running it through to the muzzle end preferably without interruption. The finishing reamer removes about .10-inch of stock from the bore with a cutting speed of not over 10 feet per minute. The cut which is about 700 inches long is started at 14.0015 inches diameter and must finish at the muzzle end with a diameter of not less than 14.000 inches. Not the least wearing down of the cutters can, therefore, be permitted and a slow cutting speed must consequently be used.



**Rifling Machine at Watervliet Arsenal Showing Arrangement for Generating Curve or Twist of Grooves.**

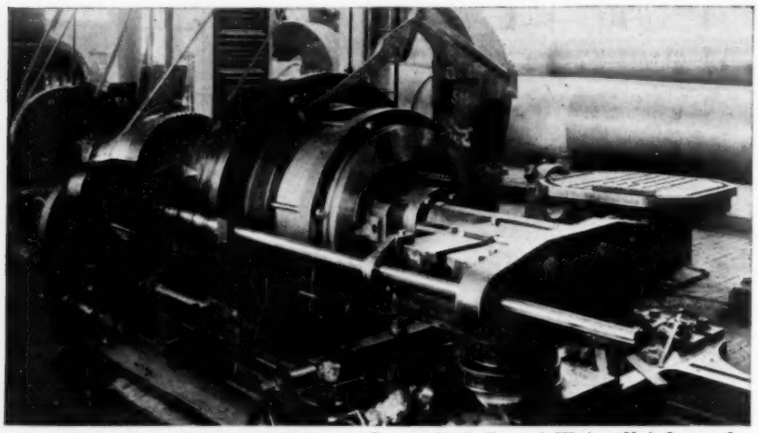
### Rifling

Cutting the rifling grooves in a major caliber cannon is one of the most accurate and delicate operations in its manufacture, and the most expensive per pound of metal removed. No real roughing cuts can be taken in this operation and as the depth of the grooves in a 14-inch gun is .12-inch it requires a great number of passes to complete the operation, particularly as not more than one-half the number of grooves at the most can be cut at a time.

The rifling head at present in use at Watervliet Arsenal for rifling guns of this caliber was developed during the World War and is commonly known as the "White" type. This head is designed to carry half as many cutters as there are grooves in the guns, the cutters being spaced so as to cut alternate grooves with individually operated cutters for cutting each groove. These cutters are carried each in a radial groove and are expanded or contracted by means of a cone sleeve or tool carrier which is a sliding fit on the shaft upon which it is located in the interior of the head. The exterior of this sleeve is provided with a series of tee slots cut at an angle of 1° 30′ with the axis of the head. One end of each rifling cutter is fitted into these tee slots. At the front of the rifling head is a projecting shaft or plunger which when forced in moves the tool carrier to the rear retracting the cutters and when moved forward carries the tool carrier with it extending the cutters. Radial adjustment of the cutters is obtained by control of the fore and aft movement of the tool carrier. This control is accomplished by means of a screw and nut attached to the rear of the tool carrier and accessible through a slot cut in the side of the head. Three sets of rifling cutters are used in rifling a 14-inch or 16-inch gun. The first set of cutters finishes the top radii of the lands and starts the groove to a depth of .03-inch and by virtue of its shape which makes it cut a slightly wider path at each pass this tool will not throw up a burr that can score the head. The second set of cutters is shaped somewhat like a parting tool with the proper radius across part of its cutting edge for finishing the bottom of the grooves to prescribed size and contour. The third, or finishing set, conforms in shape to the complete contour of the groove except the top radii of the lands which were finished by the first set. A feed of .0015-inch per cut is used for the first and second cutters and .003-inch per cut for the third cutter except that when within a few thousandths of full depth the feed is reduced to .0005-inch to insure a smooth and perfect finish. The cutting speed used is approximately 7 feet per minute with about double that amount on the return stroke.

The lubricant used consists of one part of animal or pure lard oil and two parts of kerosene and is supplied in large quantities at about 25 pounds pressure through an individual vent at each cutter. When a gun has been placed in position in the rifling machine with the muzzle end toward the rifling head and properly aligned so that the head and the following rings behind the head will pass freely through the gun then the stop for retracting the cutters at the end of the stroke is adjusted. This stop is

a rod threaded on the rear end, extending into the powder chamber, held in a central position by spider shaped supports and secured in place at the breech end where the threaded portion passes through a flat bar which is clamped against the breech face of the gun. The cutters which are interchangeable are now inserted in the rifling head and the stop nut on the feed screw set so that when fully extended the cutters will pass through the bore without touching. The stroke of the rifling bar is also adjusted so that it will be automatically brought to a stop the instant the cutters are collapsed.



**Step Threading the Breech Recess of a 16-inch Gun at Watervliet Arsenal.**

The cutters are now gradually fed out until they touch when the regular feed per stroke is begun. The desired amount of feed is obtained by backing off the stop nut, which is notched on the circumference, a certain number of notches before returning the tool carrier to extended position. The tool carrier is then moved forward, until arrested by the stop nut, by means of a small bar which is used as a lever fulcrumed from slots in the rifling head under the exposed feed screw. At the end of each return stroke the cutters are all carefully examined by the operator and any small adhesions of metal are removed with a copper scraper. When one set of grooves has been cut to full depth the head is indexed to the proper location for the second set, two settings only being required when a rifling head of the type described above is used to its full capacity. However, owing to the light construction of the rifling machine in use at this arsenal it is impossible to utilize the head to its full capacity and, therefore, only one half the total number of cutters are inserted leaving out alternate ones, thus necessitating four settings rather than two to rifle a gun of this size.

### Step Threading Breech Recess

The breech recess or breech block seat in the 14-inch gun is cut in a breech bushing and is machined complete before the bushing is assembled to the gun. The breech block used in this gun is of the "Welin" type commonly referred to as the step type. The breech block seat in the bushing is divided into four equal zones on the circumference, each zone is then divided into four equal sectors, each sector being machined to a different radius thus forming four longitudinal steps in each zone, each zone being an exact counterpart of the others. It will be noted, however, that the breech bushing shown in the illustration is one for a 16-inch gun. The largest diameter sector in each zone is not threaded and is machined to a radius somewhat larger than the root diameter of the thread in the adjacent sector. Similarly each adjacent sector is cut to a smaller radius so that the root diameter of the thread in each sector will clear the top diameter of the thread in the next larger one. Before the breech block thread is cut in the bushing the interior is slotted to form the steps and the narrow tool clearance slot between each threaded sector is cut, the exterior of the bushing threaded, fitted to the gun and quarterlined for location of the interior thread. The photograph of the step threading device shows a breech bushing mounted for cutting the interior thread. As will be noted the machine tool used is a standard screw cutting engine lathe equipped with a special attachment. This special attachment consists mainly of a cast iron housing assembled in place of the compound slide, the base being set so as to permit longitudinal adjustment by means of the compound slide screw. This housing is fitted with an extension or arm which carries the tool block slide and the generating cam in the forward end. The motion is imparted to the cam through gearing and a shaft passing through the extension or arm. The cam action is synchronised with the location of steps in the bushing by slipping out of mesh one of the pinions in the gear train and reassembling in the tooth nearest correct location. Closer adjustment, if required, can then be made by means of a dog and adjusting screw connection in the driving shaft.

In the threading operation the lead is generated in the usual way by means of the lead screw, the function of the cam device being merely to retract and advance the tool to match the different heights of the sectors. To prevent damage to fixture or work due to malfunctioning or other causes a shearing pin is provided in the drive shaft and the driving belt on the lathe left loose enough to permit slipping should the load be suddenly increased. As a further precaution the back gears on the lathe are also set so that any unusual load will throw them out of mesh.

### Latest Developments

The progress of gun manufacture has been almost continuous from the first muzzle-loader to the modern high power guns. Many radical changes have taken place from single piece gun tubes to assemblies of built-up guns, presenting many difficult problems of manufacture. The most recent change in design has been a reversion from the built-up gun back to the single piece tube. This has been brought about by increased strength of material obtained in the auto-fretted or cold worked forging. In addition to this simplification the life of the gun has been greatly increased by the use of a loose liner. With antiaircraft guns especially, the wear on the rifling is very great on account of the high powder pressures. Renewal of liners becomes a very simple operation in the field in time of war and fewer guns are kept out of service since the renewal of loose liners is only a matter of a few hours as against about six weeks' time required to replace a shrunk-in liner.

The manufacturing operations for the construction of tubes and loose liners are quite similar to and present no greater difficulties than those required for members of built-up guns.

The fact that loose liners are made with a slight taper and a very small clearance in the tube or liner seat permits them to be easily withdrawn or assembled to the gun. The relatively small clearance, however, makes it impracticable to have interchangeable liners, but no difficulty arises in this respect from a manufacturing point of view as a new liner can be made at any time from the star gage records of the liner seat for any particular gun.

**Star Gaging a "D" Hoop of a 16-inch Gun at Watervliet Arsenal.**

Loose liners have now been made for several types of guns up to and including 105-mm. antiaircraft guns. The success attending the manufacture and use of loose liners has led to the design of larger calibers. Keyways prevent the rotation of the liner and two shoulders prevent the forward movement in the tube. The keyway at the muzzle end is usually longer than the key itself to allow for the lengthening of the liner during firing. Tests with loose liners indicate that the manufacture has reached beyond the experimental stage as some liners have been fired several thousand rounds—one especially of 3-inch caliber having been fired over 3,000 rounds and is apparently in good condition for another thousand.

The manufacture of single piece gun tubes and the loose liners with which they are provided does not present any manufacturing problems not already encountered in the built-up types. The tolerances in the very accurate fitting of a loose liner are no closer than those prescribed for shrink surfaces and the boring and turning operations are quite similar to and no more difficult than those for assembled guns. Another departure which came with the one piece gun was the method of attaching the breech ring. With the first type of 3-inch antiaircraft gun, for instance, the jacket and the breech were integral. Due to forging difficulties in making these members integral the three piece construction was adopted for this gun and the breech ring in that type is threaded onto the jacket with a light shrinkage. The breech ring is then held in place with a set screw which prevents it from unscrewing during firing.

### Inspection

During all manufacturing operations each piece of work must pass through the Inspection Department before acceptance. Inspection begins with the arrival of the rough forging. A forging is first given a gun and assembly number which follows it through to completion, as for example, Hoop B3 of Gun No. 110, Forging No. F5660. As soon as telltaling is completed and a roughing cut is started the inspector watches for and records any and all defects. These defects may be slight and require only notation in the records or they may be of such serious consequences as to result in immediate rejection.

Such defects as streaks and very minute holes and sand splits are merely recorded for future reference in the gun report. Sand splits of larger dimensions and cracks—both radial and longitudinal—must be noted and if still present in the finish cut causing chips to break off should be cause for rejection. Other causes for rejection depending upon the seriousness of the defect are slag spots, ghost lines, flakes, segregation and burnt steel. Examination of both finished-bored and turned-surfaces is carefully made and all imperfections noted. In bores this examination is made with the aid of a strong light and a magnifying mirror attached to a handle and inserted into the bore; for extremely long bores, such as the tube or liner, a field glass may also be used in magnifying the area under close examination.

Next in importance to inspection for defects is measurement of dimensions. Each member after finish boring is carefully star gaged to determine the interior diameter the entire length of the bore. A 3-point star gage is used taking two complete sets of readings 180 degrees apart at intervals of one inch the entire length of the bore. All these readings must be very carefully taken and recorded as they are used as a basis for making the shrinkage drawing which determines the diameter of the male part which is turned to fit the bored hoop, tube, or jacket, making due allowances for compressions. Star gaging is followed by inspection of turned surfaces for proper diameter and this in turn by again star gaging the inner bore of the tube or foundation member after each assembly of an additional hoop to note compression until completion of the gun. All data are recorded in the record of inspection for each gun, including, most important of all, the final star gage of rifling with a set of readings for both the diameters of lands and grooves.

No cannon or part is finished without the inspector's stamp of acceptance. This stamp indicates that all parts and assemblies have been made according to drawings and proper size and also that a complete record of all such dimensions are on file and available for future reference in case of later defects in proof firing, replacement of liners, alterations or modifications.

# Shrinkage Operations in the Construction of Built-Up Cannon—As Practiced at the Watervliet Arsenal

Oscar Olson*

UP to the time of the Civil War all cannon were of the muzzle-loading type and cast in one piece, the material used being either bronze or cast iron. Shortly after the Civil War an effort was made to strengthen these cast cannon bodies by shrinking on a series of welded iron or steel bands.

As the steel industry developed and it became possible to obtain forgings of a sufficient size the cast iron tube was reinforced by layers of superimposed short hoops shrunk in place. The 12-inch mortar, Model 1886, was the first cannon of this type made in the United States, the cast iron body being thus strengthened by short outside hoops varying in length from 7 to 29 inches.

With the great advance in the steel industry it soon became possible to obtain forgings of a size suitable for guns constructed by the built-up method. Gun forgings are now being made 70 feet in length and weighing 40 tons in the rough machined condition. Such large forgings have been made at both the Bethlehem and the Midvale steel works. All forgings used in the manufacture of built-up cannon are heat treated to the desired physical properties at the steel works and rough machined before shipment to the gun plant.

The theory of the built-up gun may be outlined as follows: A gun made from a single cylinder can withstand safely no pressure greater than that which would expand its inner fibers to the elastic limit of the metal. If, however, this cylinder can be compressed so that its inner fibers have reached their elastic limit for compression then we have practically doubled the strength of the tube since we can safely introduce a pressure which will bring these inner fibers from a state of compression to the normal and then from the normal up to the elastic limit for expansion.

In the built-up gun the exterior diameter of the interior cylinder is slightly greater than the interior diameter of the cylinder which will envelop it. This latter cylinder is heated and expanded so that it will go over the former. When this outer cylinder cools and contracts it will compress the inner cylinder. The theoretical maximum increase in strength by this method of construction is more nearly approached as we increase the number of layers of these cylinders. This led to the wire-wound type of construction. It was for a time extensively used both in this country and in England.

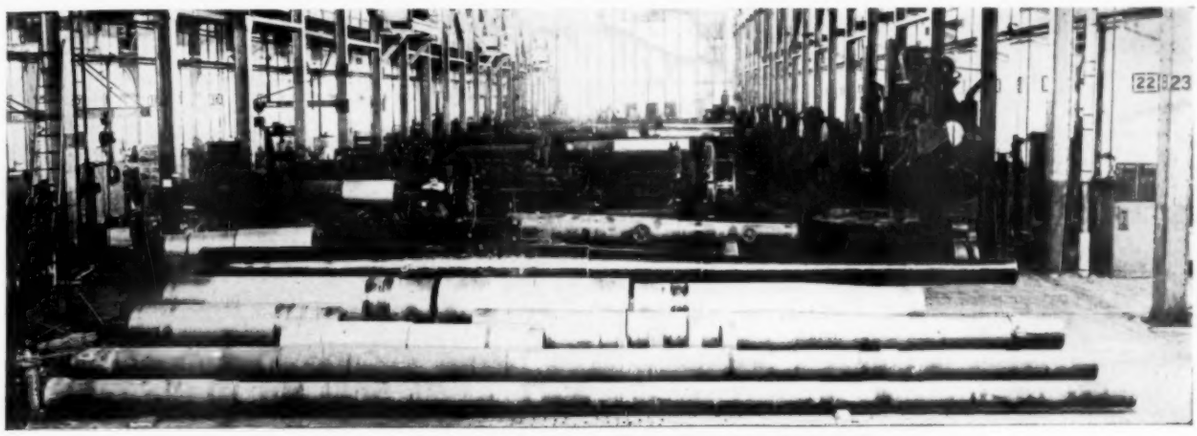
An Old Bronze Cannon.

As an example of the greatly increased power obtained by the built-up cannon over the old type cast, single piece gun, one may recall the memorable drawn battle between the Monitor and the Merrimac in Hampton Roads during the Civil War. The Monitor equipped with two 11-inch Dahlgren guns was unable to penetrate or destroy the improvised armor on the Merrimac and the guns of the Merrimac were equally powerless to inflict any serious damage on the 8-inch iron armor of the Monitor.

The projectile from the first 8-inch built-up guns constructed in this country could readily penetrate at a range of 1,000 yards iron armor 8 inches in thickness with backing or 6 inches of case-hardened modern steel armor plate at the same range.

The assembly of the various members that go into the making of a built-up gun is a highly specialized art with no commercial parallel. Years of practical experience and familiarity with the use of the equipment and a thorough knowledge of former results are absolutely essential if the results obtained are to correspond to the theoretical calculations. After a hoop has been bored and star-gaged and the male member turned to these star-gage dimensions plus the desired shrinkage the hoop is heated in an electric furnace to a predetermined temperature varying from 400° F. to 850° F. dependent on the amount of shrinkage, the diameter of the bore, and the thickness of walls of the hoop. It is also governed by the overall length of the hoop and at what point, longitudinally, in the bore the shoulder contact is located. To minimize as much as possible any tendency of the hoops to warp or buckle when heated they are generally suspended vertically in the furnace. The member on which the hoop is to be assembled is mounted in the shrink pit in a vertical position in such a manner that water for cooling can be applied to the interior of this member thus preventing it from taking on too rapidly the heat from the hoop. When the hoop is removed from the furnace, by means of an overhead traveling crane, its interior diameter is measured at both ends to insure that it has attained the desired expansion. The hoop is then moved to a position over the male member, is very carefully centered and then lowered into place. The water is at once applied in the lowest one

*Master Mechanic, Watervliet Arsenal.

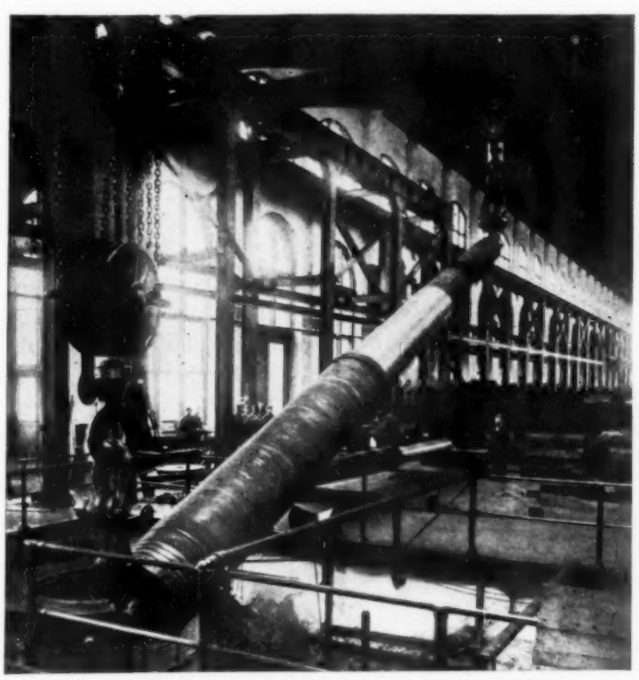


**A Built-up 8-inch 55 Caliber Gun and a Set of Rough Forgings.**

of the water rings, which is located nearest the contact shoulder. Sometimes as many as four water rings are used, during the cooling operation.

After the water has been turned on successively through these rings in their original position they are, except the first ring which remains at the contact shoulder, gradually raised following a definite time schedule. The outer cylinder is thus brought gradually into contact with the inner member as by this cooling and shortening process it is drawn to the shoulder where contact must be maintained.

On some of the larger hoops on a 16-inch gun as much as 55,000 gallons of water are used in the cooling operation which occupies almost one hour. When the contact shoulder is some distance from the end of the hoop, protection must be provided against too rapid cooling below the contact shoulder. This is accomplished by fastening on the hoop a few inches below the shoulder a conical sheet metal hood to shed the water. In assemblies of this nature the water is first applied a short distance below the actual shoulder in order to pull the hoop hard against the shoulder. This insures that no slippage will take place when the gun is subjected to firing strains. Sometime it is necessary to invert the common practice of assembling the heated hoop over the male member and instead insert the male into the heated hoop, this is generally called "muzzle insertion." This happens if the contact shoulder, against which a certain amount of pull should be assured in the assembly, is located close to one end of the hoop, it then becomes necessary to invert the process in order to cool away from the shoulder.



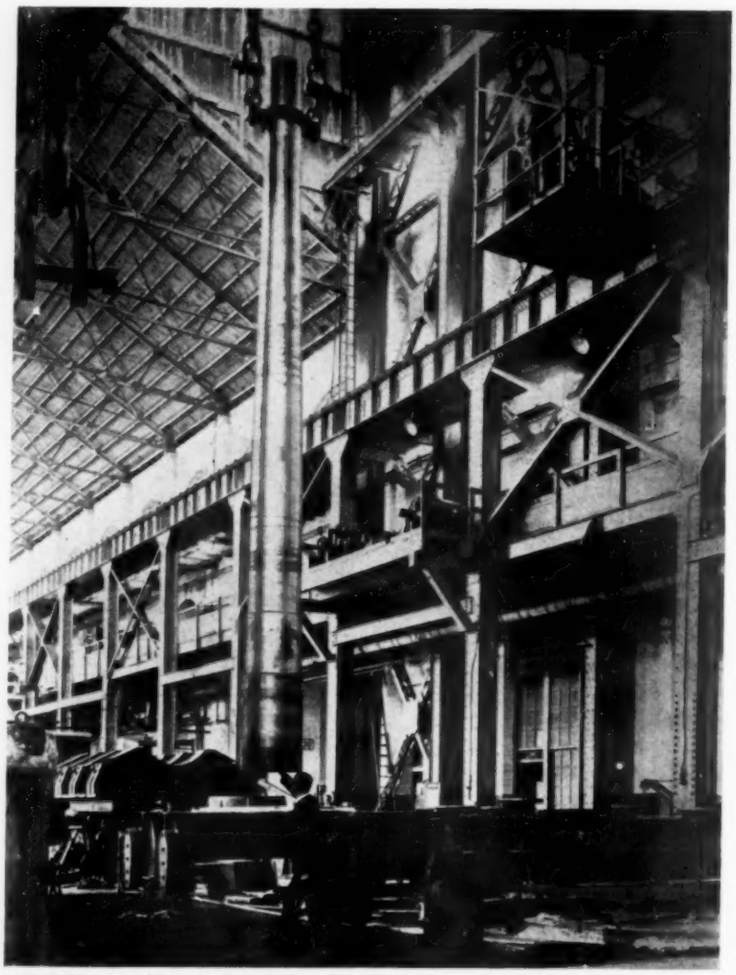
**A Partly Built-up 16-inch Gun Being Lowered into the Shrink Pit.**

As previously stated hoops are frequently heated as high as 850° F. This is a much higher temperature than is necessary for actual assembly but the additional clearance is needed to keep the hoop from gripping the inner cylinder above the water rings as they travel upwards. Taking as an example one of the longest hoops on an 8-inch Navy gun the maximum expansion in this hoop when heated is about .10, whereas the shrinkage is not over .023, the cooling operation taking about 35 minutes.

The successful assembly of inner tubes or liners of the latest type is a very difficult operation partly due to the location of the shoulder which in some cases is about 3 inches from the rear end of the piece. The exterior surface of such liners is conical with a taper varying from 0.002-inch to 0.007-inch per inch. This taper facilitates assembly and permits the use of a much lower temperature in heating the guns. For instance, a 16-inch liner approximately 69 feet long can be assembled, both members cold, to within 6 inches of being seated if the taper is 0.003-inch per inch and the shrinkage 0.018-inch. With an average shrinkage of .018 it would only be necessary to heat a 16-inch gun of that type to about 125° F. above shop temperature in order to assemble the liner, if actual insertion were all that need be considered. At the above temperatures the liner and the gun would be in actual contact but the gun would be about 0.70-inch longer than the liner. Under such conditions of assembly the liner would rise off the contact shoulder at the rear end rather than push its way downwards against the taper. To provide a satisfactory working clearance, it is, therefore, necessary to use a higher temperature, although much less than the heat required for a cylindrical assembly.

In the case of the 8-inch 55 caliber Navy gun which has the contact shoulder located about 3 inches from the rear end of the liner the assembly is as follows: The gun, completely built up except liner, is mounted, breech end up, in an electric furnace and brought to a temperature of 450° F. at the breech end and 575° F. at the muzzle end. The liner is prepared for assembly by having the bore threaded at each end for closing plugs to retain the water circulating in the liner after being lowered in the gun. A 2½-inch iron pipe extends through the muzzle plug to an outlet in the bottom of the furnace. The lower end of this pipe is closed by a removable plug and the upper portion within the liner extends to within 39 inches of its top. The breech closing plug is provided with a 1¼-inch water inlet pipe which extends down within the liner to a point 1½ inches from the bottom or muzzle end. The breech end plug is also provided with three outlet pipes which when the liner is assembled in the gun, extend beyond the furnace and discharge the overflowing water until the plug in the lower end of the outlet pipe is removed. The 2½-inch outlet pipe in the bore of the liner is provided with 10 flapper valves lined with soft rubber and located an equal distance apart. These valves are controlled, each one with a pull wire extending through the breech end plug. The liner is filled with water before being lowered into the gun which remains in the furnace. The instant the liner is seated connection is made to the inlet pipe in the breech plug and the water turned on, the circulating water then escaping through the overflow pipes. At the same time the equipment which has been suspended in readiness from another crane is brought over the furnace, attached to the gun and a pressure of 200 net tons applied to the breech plug to assist in holding the liner on its seat. The instant this pressure is attained the plug in the lower end of the outlet pipe is pulled and the water level in the liner is thus lowered to the top of the outlet pipe permitting the upper 39 inches of the liner to take on the heat of the gun. After a proper interval of time each successive valve is pulled allowing about 4 feet additional of liner surface to come in contact with the gun for each valve opened. The time required to lower the liner in place and hook up the hydraulic jack is approximately four and one-half minutes, the time of circulating water in the liner about 47 minutes.

The equipment for holding the liner on its seat consists of a 350-ton hydraulic jack fastened to a cross beam with a rod attached to each end. The lower ends of these rods connect with trunnions on a large strap clamped to the rear end of the gun. When in place, with the jack extended, pressure is exerted between the lower edge of the beam and the top of the breech plug in the liner, the beam being held against upward movement by the rods. With this equipment it has been possible to hold these liners in actual contact at the shoulder.



**B-3 Hoop for 8-inch Gun Being Checked by an Inspector for Expansion.**

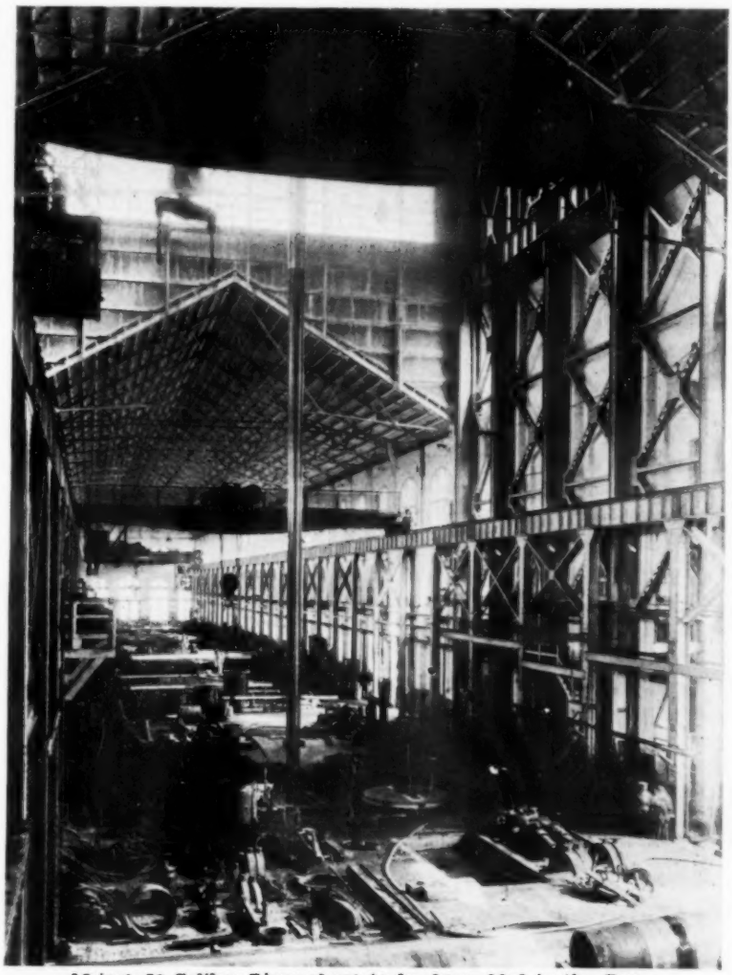
The disassembly or unshrinking of parts assembled with shrinkage is a problem presenting interesting features. This practice is resorted to in retubing and relining work. The term "unshrinking" in the Watervliet Arsenal shop language means to break the contact between and separate two cylinders that have been assembled by shrinkage. This is accomplished by heating the compound cylinder and then by a sudden cooling of the inner member contract it away from the still heated and expanded outer member allowing separation. To accomplish this operation successfully it is generally necessary to heat the parts to at least 850° F. The removal of a liner from a 12-inch gun is accomplished as follows: The breech and muzzle ends of the bore are threaded for closing plugs, the plug in the muzzle end being provided with a 1½-inch outlet. The breech plug is provided with two 2¼-inch inlets and eight 1½-inch outlets. The gun is put in the furnace with the muzzle end down and heated to the desired temperature. When heated and thoroughly soaked through to an even temperature the gun is removed from the furnace and brought to rest, on the muzzle end, on a solid platform provided in the pit, and held in this position by

side braces while the lifting tackle is shifted and water connections made. The lifting tackle, which up to this point consisted of side rods attached to the trunnions of a clamp fastened against a shoulder on the gun or directly on the gun trunnions, is now quickly removed and the crane hook connected to a large eye bolt screwed into the top end of the breech closing plug. In the meantime the two 2¼-inch hose have been connected to the water inlets and a slight strain is now exerted by the crane enough to completely straighten the gun to a dead vertical position but not enough to lift it. The water is now turned on and as soon as it is flowing through the outlets without bursts of steam the gun is raised about four inches above the platform being now held suspended entirely by the breech end plug. About one and one-quarter to two minutes are usually required until the gun drops loose and the liner is hoisted free.

The removal of all taper liners regardless of size of gun is done in practically the manner described above.

To disassemble a gun for retubing is somewhat of a variation of the same problem. Guns susceptible of retubing are generally constructed of three members, the tube, the jacket and the breech ring, the jacket covering the tube from the breech end about two-thirds the length of the tube and the breech ring threaded with a shrink fit, on the rear end of the jacket. As the tube is provided with a collar on the rear end it is obviously impossible to remove the tube from the jacket before the breech ring is removed. To disassemble the outer member of parts assembled with shrinkage by the interior cooling method is, however, impracticable when there are three or more layers. This is due to the fact that when cooling is applied from the interior the contact between the two inner layers is first broken and from that moment there is no longer any appreciable radiation outwards beyond the broken contact.

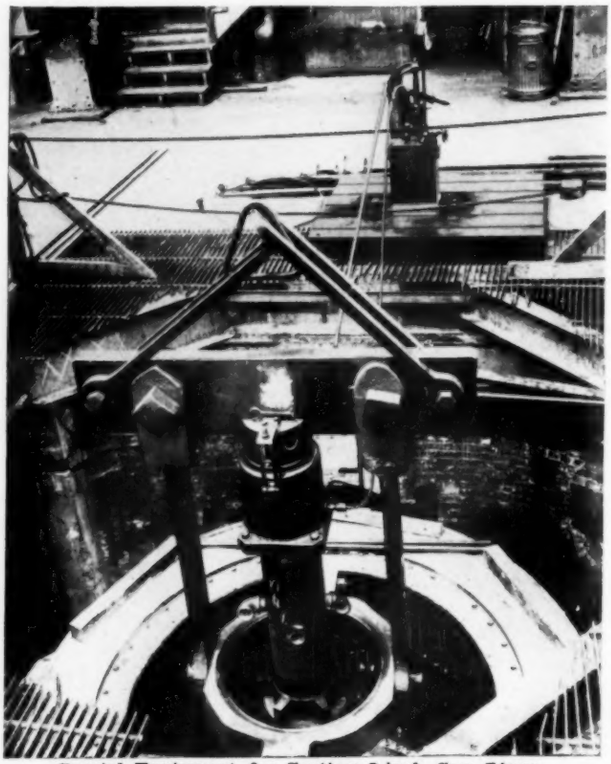
For the above reasons it is necessary before attempting to disassemble the breech ring first to remove by boring that part of the tube which is directly under the breech ring thus exposing the interior of the jacket to the cooling water. The gun is then heated, removed from the furnace and clamped breech end up in a frame. Passing through this frame is a pipe in a vertical position with its upper end plugged and the walls perforated for about 10 inches with a number of small holes. The gun is lowered into the frame until the breech end of the jacket is even with stand pipe and then clamped in place. The water is then turned on in the pipe and the spray brought to play on the bore of the jacket immediately under the threaded surface for the breech ring. In about 20 to 40 seconds the shrink will be broken and the breech ring can be unscrewed.



**16-inch 50 Caliber Liner about to be Assembled in the Gun.**

When relining worn out cannon was first attempted the liners were turned cylindrically, in zones of increasing diameters towards the rear end. In assembling liners of this construction it was naturally necessary to provide greater initial clearance than is required for the assembly of taper liners and consequently a higher temperature had to be used. In an attempt to seat a liner of this type on its contact shoulder, located about at the origin of the rifling, the rear end of the gun was cooled with rather a sad result; it was found that the exterior hoop had, in the cooling operation, become loose on the gun, this being due to over-stress when suddenly cooled on the heated and expanded inner member. This failure, however, was instructive in that it showed a possible method by which compound cylinders could be disassembled should the occasion arise. About two years ago Watervliet Arsenal received a request for a large forging to be used in the construction of a centrifugal casting machine. There was, at the time, on hand a 12-inch gun, Model 1888MI½, with the muzzle section blown off. The jacket forging in this gun was about of the size desired but in order to obtain it, it would be necessary to remove the two outer layers of hoops assembled over the jacket and the tube on which the jacket was shrunk. The disassembly was accomplished as follows: The section of the gun to be dismantled was suspended in the furnace and heated to about 950° F. When heated through it was placed in

the pit and the spray from five water rings applied on the exterior of the hoops to be removed. In about one and one-half hours the hoop at the rear end dropped off and the one adjacent in about two and one-half hours. The gun was again heated this time to about 1050° F. in order to remove the next layer of hoops and the spray applied through five water rings as before. The rear end hoop this time dropped free in one hour and eight minutes, the second in one hour and twelve minutes, the third in one hour and twenty minutes. The tube was later removed from the jacket in the regular manner as previously described in retubing operations. Calculations showed that the expansion obtained by a temperature of 500° F. would stress the outer surface of the exterior layer of hoops equal to the elastic limit if cooled over a mandrel of that size, the inner layer of hoops representing the mandrel. Also that by heating to a temperature of 950° F. an expansion of about 0.24-inch would be obtained at the contact surface of the outer layer of hoops which would be sufficient to stress the outer surface of the exterior hoops about 100 per cent. over the elastic limit if the hoops were cooled in this expanded condition, while such parts of the metal, if any, that were not stressed beyond the elastic limit would contract as the cooling progressed. However, since the hoops actually became free it is evident that even the interior surface of the hoops was stressed or radially expanded beyond its previous elastic limit. A permanent set of 0.058-inch took place in the bores of the outer hoops in the disassembly, this set exceeding the original shrinkage by only 0.01-inch. This small clearance accounted for the long time required in the cooling operation as the inner hoops had to be completely cooled before any clearance was obtained. The total cost of the above salvage operations was approximately $1,340.00, whereas the cost of a new jacket forging alone would have been about $6,400 at 20 cents per pound. In addition to salvaging the jacket, five other large hoops weighing approximately 45,000 pounds, of a somewhat higher elastic limit than the original were thus preserved at a very slight cost. Such an operation has an economic as well as a research value.



**Special Equipment for Seating 8-inch Gun Liner.**

## Our Munitions Reserve In Desperate Circumstances

"IN only one phase of our material preparedness are we in desperate circumstances. We have no munitions to bridge the gap between the last hour of our rapidly deteriorating and fast antiquating supply and the day when industry can get under way in its quantity production.

"Three months after our Regulars and National Guardsmen recruited to strength go into action—not a rifle—not a machine gun on the ground or in a place—not a 'seventy-five' will be able to speak with authority.

"The best possible advance planning for the manufacture of that kind of authority leaves a gap of from six to nine months and, during that time, a helpless army. Do you want your sons called to the colors with any such situation confronting them and the nation they will be expected to protect?

"You have the right to say to those of us who are charged with the national protection, 'Why don't you do something about it?' * * * *

"Nothing is so expensive as paying the peace-time charges of a military establishment which cannot deliver in emergency. You pay your annual premiums, but you would have little prospect of actually collecting any accident insurance.

"Wars are accidents, terrible accidents. The world is still convalescing from the last series. In that free-for-all, we were all badly hurt. We want no more of them.

"American industry prevents accidents by the installation of all possible safeguards, by 'Safety First' campaigns and by constant education. Nations can well follow its example.

"America's best 'Safety First' campaign lies in a sound and comprehensive program of Industrial Preparedness. Accidents don't happen to those who are properly safeguarded against them and prepared to meet them. When, through pure bad luck and despite all reasonable precautions, they do occur, the damage is slight and the results never fatal.

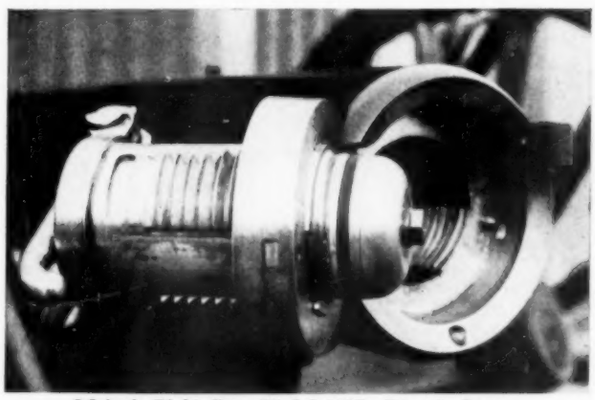
"With these measures, education to prevent such national and international accidents must go on. Forgetting them, or disregarding their causes—well-meaning pacifists to the contrary—will not prevent them. We know from bitter experience that a sincere disposition to avoid them in itself—as any perusal of our history will prove—is not enough."—*From an address by Col. Hanford MacNider, Assistant Secretary of War, before the National Association of Manufacturers at Chattanooga, Tenn., October* 26, 1927.

# Present Trend in Breech Mechanism Design

John D. DeVoge*

UP to the close of the Civil War the artillery of this country consisted of muzzle-loading smooth bore cannon. Following this period the rifled bore was adopted to give the projectile a rotation on its axis with greater stability in flight and consequent increased accuracy. The advent of the rifled bore emphasized the necessity for the breech-loading type as it was difficult to provide the projectile when inserted from the muzzle with an effective seal against the escape of the powder gases through the rifling grooves and also a positive driving force to rotate the projectile. With breech loading these defects are eliminated.

A breech mechanism is a mechanical device for closing the rear end of the bore of a gun after loading. The term includes the breechblock, all mechanism contained in or with it, and the necessary operating gear. The principal requirements of a successful breech mechanism may be said to be: safety, ease and rapidity of working, not easily put out of order, ease of repair, interchangeability.



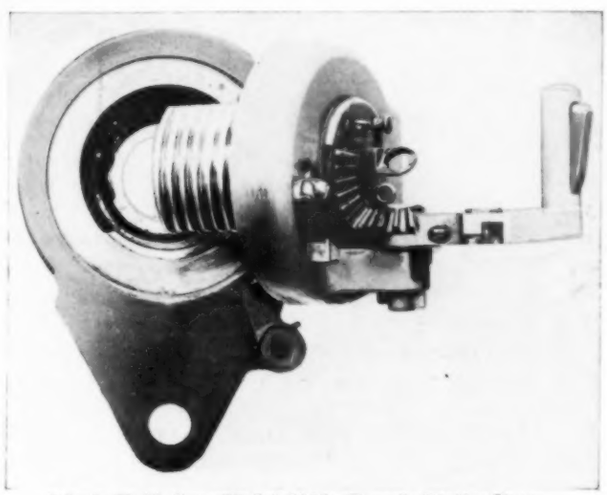
3.2-inch Field Gun, Model 1885—Breech Open.

There must be provided some device which will prevent the powder gas from escaping to the rear. If any passage is open the gases are forced through it with great velocity by the high pressure existing in the bore. Their velocity, together with their high temperature, gives to them great erosive power, and the threads and parts of the breech mechanism are eroded to such extent that they are soon rendered useless.

There are in use two principal devices for preventing gas leakage to the rear; one for use in cannon using separate loading ammunition, and the other in cannon using fixed ammunition. In the former device, known as the obturator type, the obturator composed of a plastic pad and steel split rings is mounted on a spindle between the front face of the breechblock and the rear face of the mushroom head on the obturator spindle. The pressure of the gases on the mushroom head compresses and expands the pad and split rings against the walls of the gas check seat in the chamber. In the latter type the propellant charge is fixed in a metallic cartridge case formed to fit the powder chamber and obturation is obtained by means of the expansion of the case against the walls of the chamber under pressure of the firing charge.

Progress in the development of breech mechanisms was slow and not until the early eighties was the actual replacement of the muzzle-loading field guns with breech loaders undertaken.

The first breech loading gun manufactured at the Watervliet Arsenal was the 3.2-inch field gun, Model 1885. The principal parts of the breech mechanism of this gun consist of the breechblock, block, carrier ring, obturator, lever handle, breechblock handle and vent cover. The breechblock is of the interrupted screw type and is inserted from the rear. The block is provided with screw threads on its outer surface which engage in corresponding threads in the breech of the gun. To facilitate closing and opening, the threads on the block and in the breech recess are interrupted. The surface is divided lengthwise into six equal sectors and the threads of the alternate sectors are cut away. The threads in the breech recess are similarly treated. The block may then be rapidly closed nearly to its seat in the gun and when turned one-sixth of a turn the threads on the block and in the breech recess are fully engaged and the breech closed. The breechblock is bored axially to take the obturator spindle which carries the obturator parts. The lever handle serves to rotate and lock the breechblock. The breechblock handle is used to withdraw the block. The carrier ring is hinged to the left-hand side of the breech end of the gun and serves to support the block and swing it to loading position. The obturator spindle is bored axially for the vent through which the charge is ignited. The vent cover is a bar which rides in a cam groove in the carrier ring and automatically covers the vent until the breech is fully closed and locked.



3-inch Field Gun, Model 1902—Breech Partly Open.

### 3-inch Field Gun, Model 1902

An improved design was brought out with the adoption of the 3-inch field gun, Model 1902. This gun uses fixed ammunition. The cartridge case is fitted with a sensitive center-fire primer which is exploded by a blow from a firing

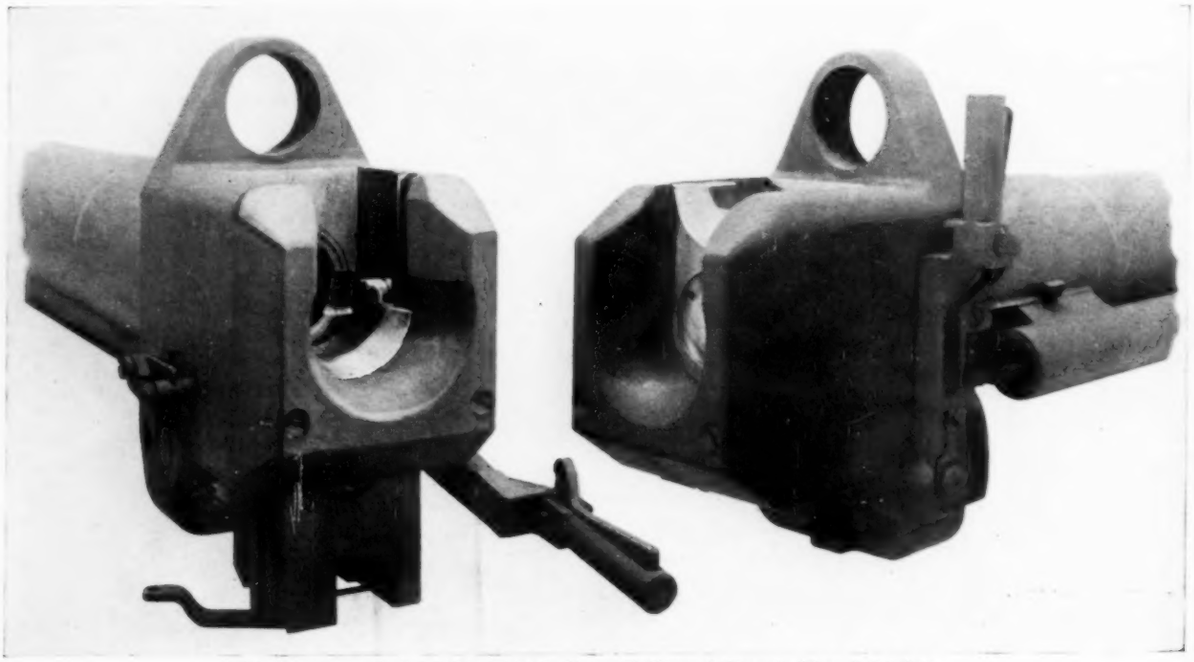
*Chief, Specifications Section, Watervliet Arsenal.

pin located in the breechblock. The principal parts of the breech mechanism consist of the breechblock, block carrier, operating lever, extractor and firing mechanism. The breechblock is of the interrupted screw type having two threaded and two plain sectors. The block carrier is hinged to the right-hand side of the breech by the hinge pin and two hinge lugs. Clearance cuts are made in the breech recess to allow the block to swing directly into the breech about the axis of the hinge pin. The breechblock is operated by the operating lever which is pivoted to a lug on the block carrier. The lever has a handle at its free end and a segment of a bevel gear at its pivot end which meshes in a segment of a bevel gear on the rear face of the block. On pulling the lever handle to the right, the first 117° rotates the block until the threaded sectors are disengaged. A further movement of 90° swings the block and carrier on its hinge until the bore is free for loading. The firing pin is eccentrically located in a recess in the breechblock when the breech is unlocked. As the breech is closed the pin automatically moves to axial alignment with the bore and primer. This is a safety feature which prevents accidental discharge of a round before the breech has been fully closed and locked. The gun may be fired either by a pull of a lanyard attached to the trigger or by means of a firing handle on the cradle of the gun carriage. The extractor is ring shaped and is located in the breech recess. It has two lips which engage on opposite sides under the rim of the cartridge case and is operated by the block carrier to eject automatically the empty case when the carrier swings to the open position.

Following the 3-inch gun, Model 1902, several models were adopted and manufactured which while following the same principles in design contained many improvements and refinements; among them were the 3-inch guns, Models 1904 and 1905, 4.7-inch gun, Model 1906, 3.8-inch howitzer, Model 1908, 6-inch howitzer, Model 1908, and others which for lack of space will not be referred to in detail.

### 75-mm. Gun, Model 1916

The breech mechanism on the 75-mm. gun, Model 1916, is known as the drop block type and is semiautomatic in that the breech closes automatically when a round of ammunition is inserted. The breech is opened by means of a lever on the right-hand side of the breech ring. Pulling back on the lever slides the block down in the vertical breech recess and operates the extractors to eject the empty cartridge case. When the extractors eject the case they also lock the block in the open position. When a round of ammunition is inserted smartly into the chamber, the rim of the cartridge case strikes the lips of the extractors and moves them forward releasing the breechblock, which immediately rises to the closed position, being propelled by the closing spring. The closing spring is enclosed in the spring case attached to the right-hand side of the gun and acts on the breechblock through the spring piston rod, chain and operating shaft. The gun is fired from the left-hand side of the carriage or by a lanyard attached to the trigger shaft. The firing pin is cocked and fired by one continuous pull on the lanyard or by the firing lever on the carriage. This type of breech mechanism is also used on the 3-inch antiaircraft gun, Model 1918.



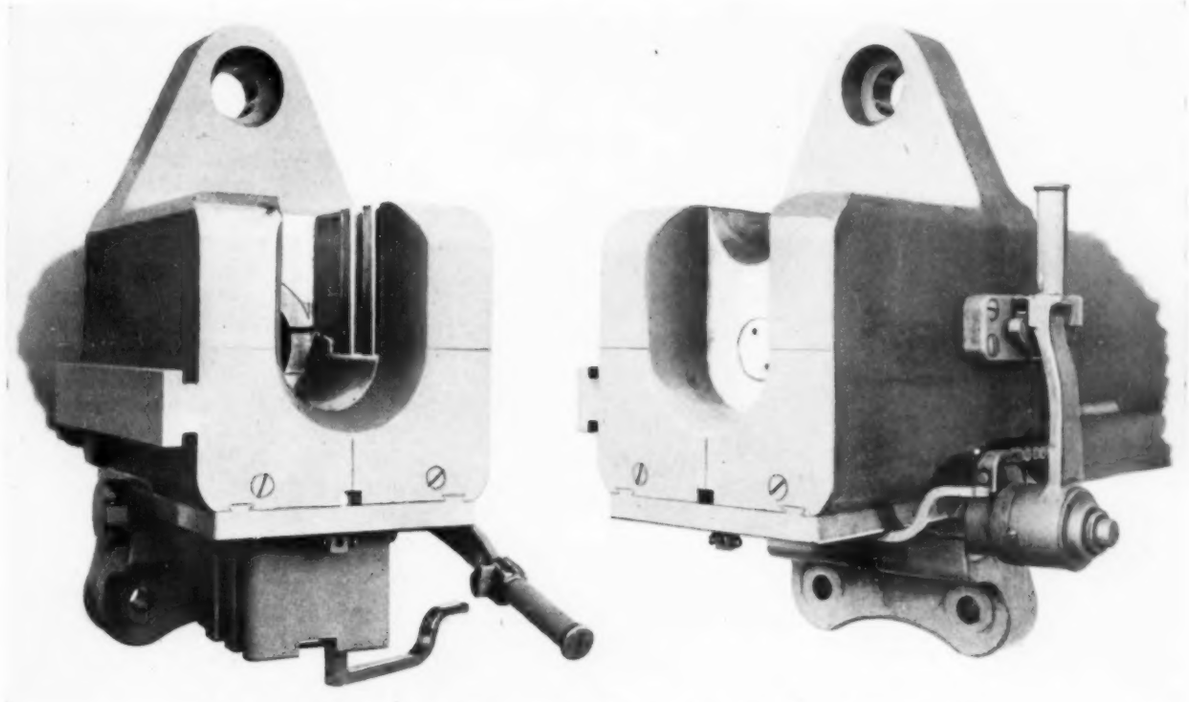
**75-mm. Gun, Model 1916—Breech Open (left) and Breech Closed (right).**

### 3-inch Antiaircraft Gun, Model 1917

The mechanism for the 3-inch antiaircraft gun, Model 1917, follows the same general lines of the 75-mm. gun, Model 1916, except that it has an additional automatic feature in which the breech is opened automatically during the counter recoil of the gun. A high rate of fire can be obtained with this gun at any angle of elevation. The operating handle on the right-hand side of the gun normally remains latched and immovable during firing and is not used except for the first loading.

### 3-inch Antiaircraft Gun, T1

The breech mechanism of the 3-inch antiaircraft gun,



**3-inch Antiaircraft Gun, Model 1917—Breech Open (left) and Breech Closed (right).**

T1, contains the same features as the 3-inch antiaircraft gun, Model 1917, with the exception that the firing mechanism is self-contained in a firing case in the breechblock. Should any parts of the firing mechanism fail during action the case may be withdrawn and replaced and firing resumed within a few seconds.

### 105-mm. Antiaircraft Gun, T1

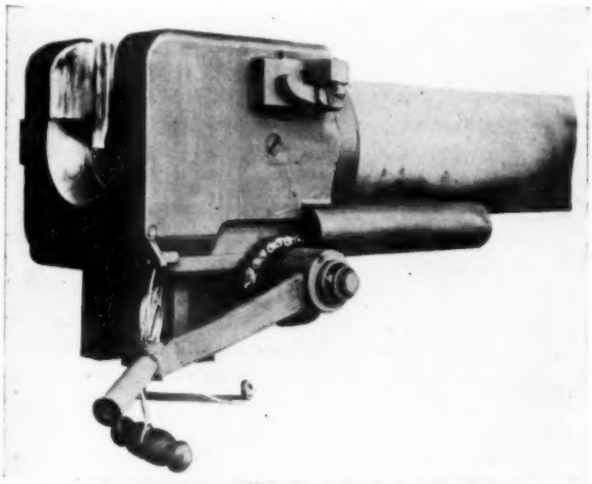
The breech mechanism for the 105-mm. antiaircraft gun, T1, is similar in design to the 3-inch antiaircraft gun, Model 1917, with two exceptions: the mechanism has no operating handle and the closing spring is housed in a vertical position in the breech ring.

### 75-mm. Gun, T1

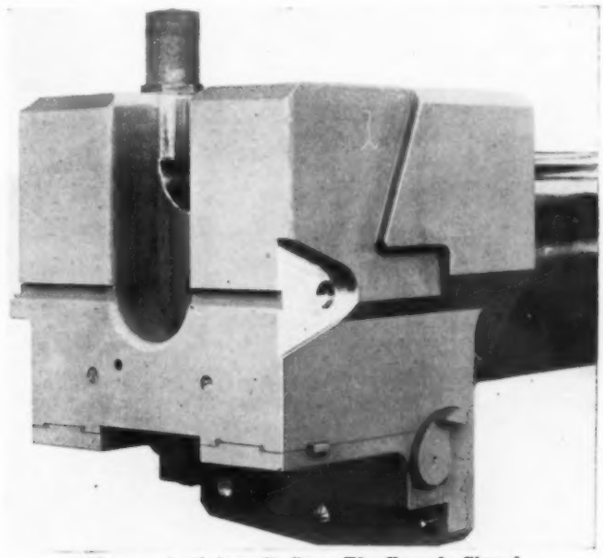
The breech mechanism for the 75-mm. gun, T1, is of the drop-block type. The mechanism is much lighter than that of the 75-mm. gun, Model 1916, and is entirely hand operated. The breechblock is counterbalanced by a vertical spring case mounted on the left-hand side of the breech ring, connected to a crank on the end of the crank shaft. The breech is opened and closed by means of the operating handle on the opposite end of the crank shaft. The firing mechanism consists of a firing pin and a percussion hammer. A pull on the lanyard swings the hammer against the firing pin and fires the gun.

### 37-mm. Gun, T1

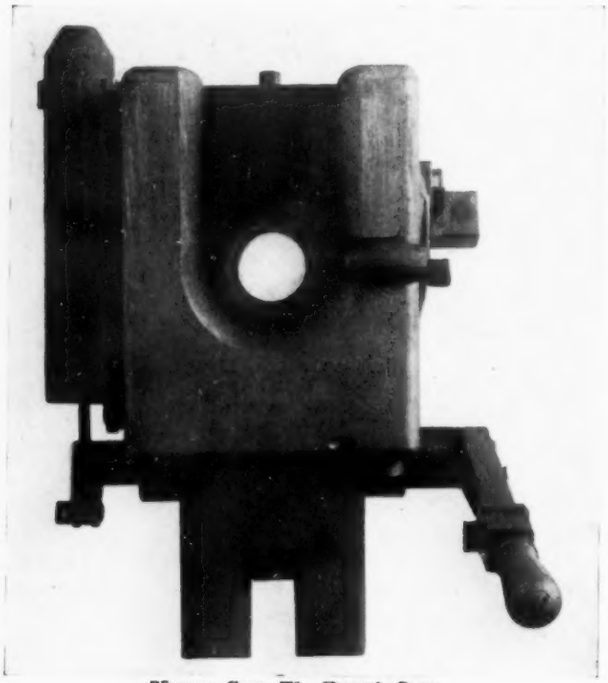
The breech mechanism for the 37-mm. gun, T1, is also a drop block mechanism using a percussion hammer. The breechblock is not counterbalanced as is the larger caliber. The breechblock is operated by a short lever on the top of the gun. The lever handle carries a latch which holds the lever and block in the closed position. Releasing the latch



**3-inch Antiaircraft Gun, T1—Breech Open.**



**105-mm. Antiaircraft Gun, T1—Breech Closed.**

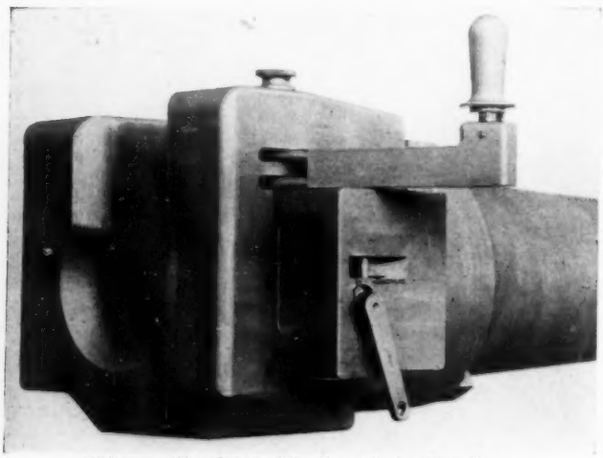


75-mm. Gun, T1—Breech Open.

causes the breechblock to drop and eject the empty case. Firing is accomplished by a pull on a lanyard attached to the hammer. The breechblock contains a hole large enough to admit a round of ammunition. This hole is in axial alignment with the bore when the breech is open.

### 105-mm. Howitzer, T1

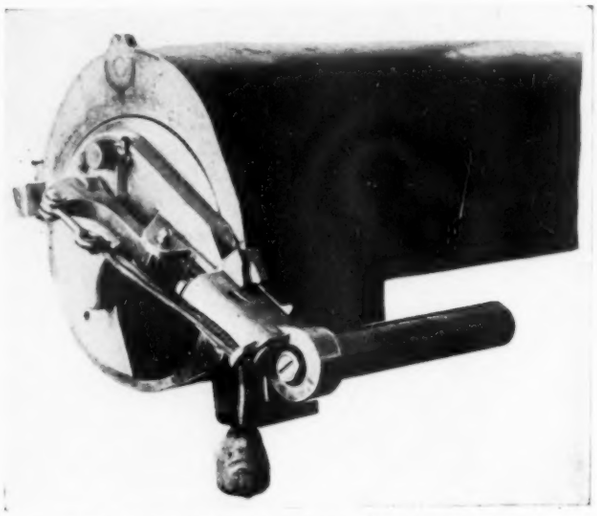
The breech mechanism of the 105-mm. howitzer, T1, is of the horizontal sliding block type. The breech is opened and closed by an operating lever pivoted in the upper wall of the breech recess. Unlatching the lever and pulling to the right draws the breechblock to the right and operates the extractor to eject the case. The firing mechanism is similar to the firing mechanism in the 3-inch antiaircraft gun, T1.



105-mm. Howitzer, T1—Breech Partly Open.

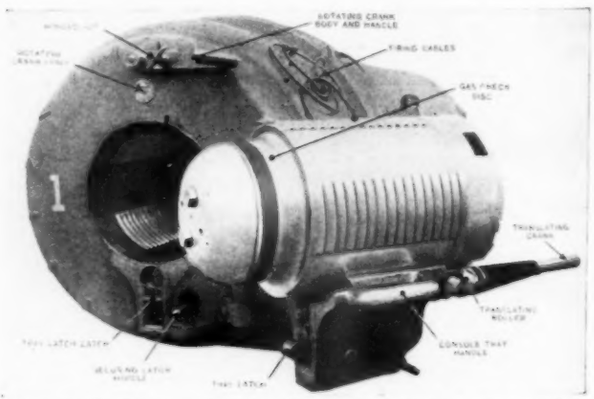
### 75-mm. Gun, Model 1897 (French)

The mechanism of the 75-mm. gun, Model 1897 (French) is of French design. A considerable number were, however, manufactured in this country during the World War.



75-mm. Gun, Model 1897 (French)—Breech Closed.

The breechblock is called the "Nordenfelt" type; it is cylindrical in form and threaded on its outer surface to screw into the breech recess. The axis of the block is eccentric to the axis of the bore, and the breech is opened or closed by rotating the block 156° about its axis. This rotation moves a U-shaped opening called the port and the firing pin alternately into axial alignment with the bore. Firing is effected by a pull followed by a sharp release of the lanyard attached to the percussion hammer.



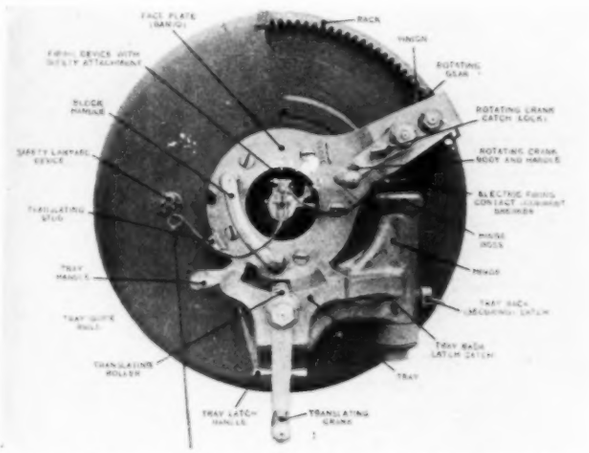
Breech Mechanism (interrupted screw) 10-inch B. L. Rifle, Model 1888—Open.

While the cartridge case type of obturation is used on the light artillery the plastic pad and split ring type of obturation is still in use on the intermediate and heavy artillery. Some of the developments in the heavy artillery will now be considered.

### 8-inch, 10-inch and 12-inch Guns, Model 1888

The first breech mechanisms for heavy cannon manufactured at the Watervliet Arsenal were for 8-, 10- and 12-inch guns, Model 1888. The breech mechanism consists of the breechblock, obturator, tray, breech plate, rotating gearing and translating roller. The breechblock is of the interrupted screw type, inserted from the breech end and rotated to locked position in one-fourth of a turn. The block is supported on a bronze tray which is hinged to the right-hand side of the breech plate. The block is translated from the tray into the breech and withdrawn onto the tray by

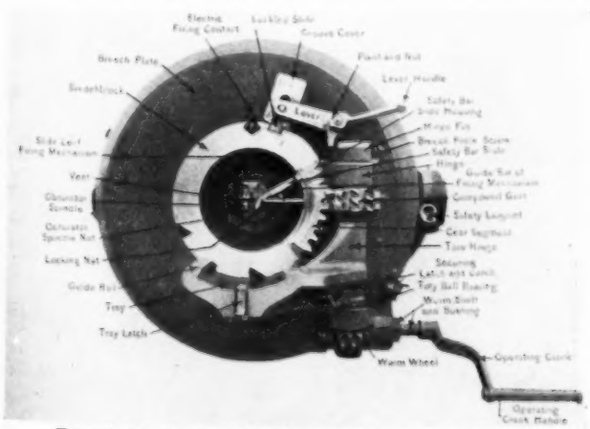
means of a crank attached to the translating roller. The translating roller is threaded on its entire length with a coarse pitch right-hand thread fitting similar threads in the tray and a coarse lead left-hand thread which engages a translating stud on the block. The block is rotated by means of another crank attached to a rotating gear mounted in the breech plate which covers the rear face of the gun. The rotating gear meshes in a segment of a gear attached to a sectored ring which engages the breechblock when the breech is closed. The breech is opened by turning the rotating crank clockwise until the translating stud on the block moves into the translating roller threads. Turning the translating crank contraclockwise four turns draws the breechblock out onto the tray and unlatches the tray from the breech face of the gun. The tray may then be swung around on its hinge until it reaches the loading position where it is held by the tray back latch. To close the breech release the tray back latch, the tray is swung against the face of the gun, the motion of the translating crank is reversed until the block is seated and then that of the rotating crank.




**Breech Mechanism (interrupted screw) 12-inch Mortar, Model 1890 M1—Closed.**

### 12-inch Mortar, Model 1890

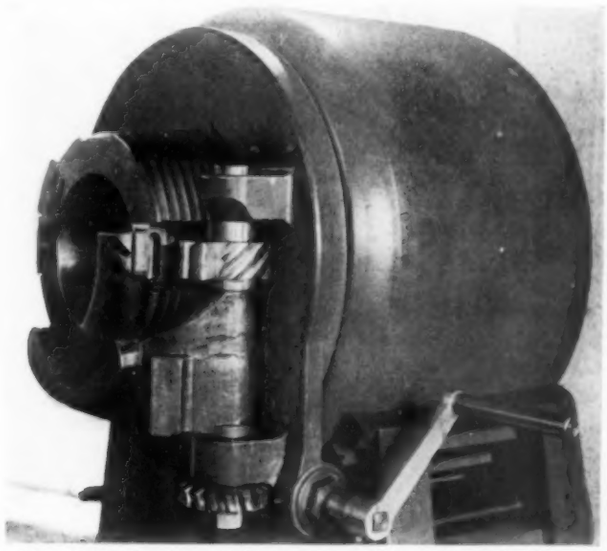
The breech mechanism for the 12-inch mortar, Model 1890, retains the same tray and translating features but the rotating mechanism differs. The rotating gearing is contained in a banjo-shaped bracket fastened to the breechblock. When the breech is closed the rotating gear meshes with rack teeth on the breech face of the mortar. The rotation is effected by means of a rotating crank through a train of gears to the rotating gear.




**Breech Mechanism (Stockett) 12-inch B. L. Rifle, Model 1900—Closed.**

### 12-inch Gun, Model 1900

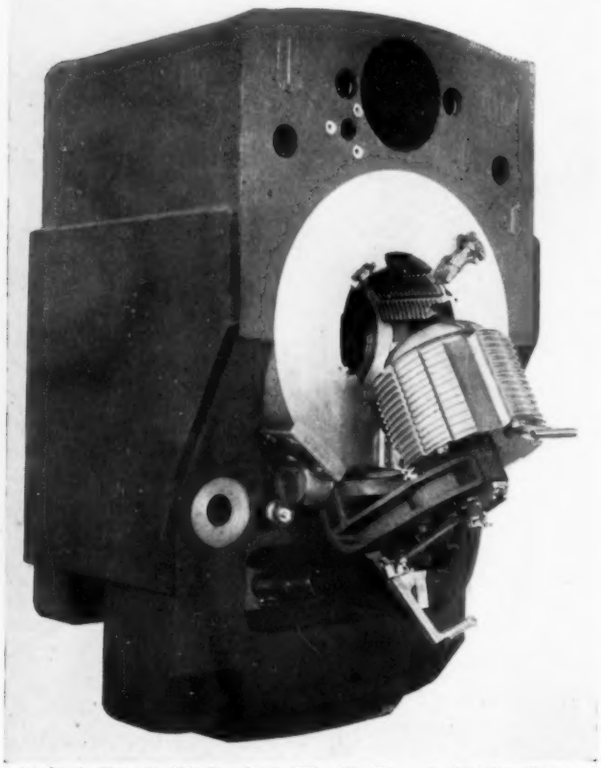
The breech mechanism for the 12-inch gun, Model 1900, contains a number of improvements over the previous models. Translation and rotation of the breechblock is accomplished by one crank through the medium of a worm, worm wheel, compound gear and rotating and translating racks on the breechblock. When the breech is closed the block is automatically locked by a device mounted on the breech face of the gun. To open the breech the block is unlocked by pulling down on the locking lever. The crank is rotated continuously towards the muzzle: this rotates the block, withdraws it onto the tray and then swings the tray and block around to the loading position. Closing the breech is effected in the reverse order, except that the locking device works automatically. An improved firing device is incorporated on this gun. It is known as the seacoast firing mechanism, Model 1903. This mechanism was later installed on previous models. Firing is accomplished either mechanically by a lanyard or electrically.



**Breech Mechanism, 14-inch Gun, Models 1907 and 1910—Breech-Block Partly Withdrawn.**

### 14-inch Gun, Models 1907, 1909 and 1910

The breech mechanisms for the 14-inch guns, Models 1907, 1909 and 1910 follow the same general principle of the 12-inch gun, Model 1900, except that the breech threads are engaged by rotating the block one-twelfth of a turn. The breechblock is known as the "Wellin" type or stepped thread block. The periphery of the block is divided into twelve segments, nine of which are threaded and three are blank. These segments are in three sets, each set containing three threaded and one blank segment. These segments are, beginning with the blank segments, of increasing radial height. The breech recess is sectored with corresponding segments. To unlock the breech, the block is rotated one-twelfth of a turn which rotates the threaded segments into the segment of larger radius in the breech and clears the block for withdrawal onto the tray. This feature gives two advantages in that there is a larger proportion of thread engagement which permits a shorter breech recess and

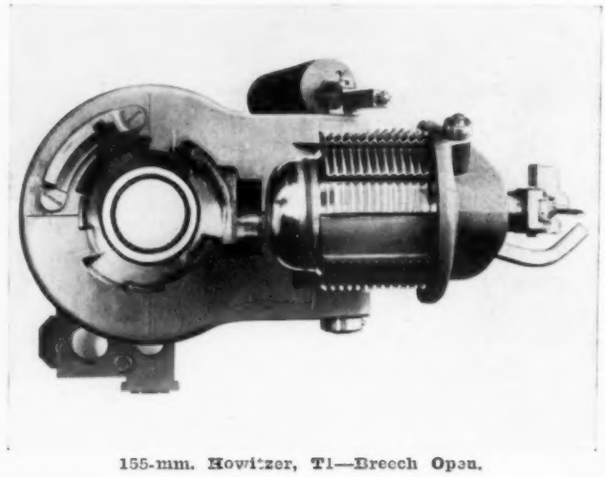


**14-inch Breech Mechanism, Mk. II—Breech Partly Open.**

breechblock and also a shorter arc of rotation to lock the breech. The firing mechanism is the same as on the previously mentioned model.

### 14-inch Breech Mechanism, Mark II

The 14-inch breech mechanism, Mark II, on 14-inch gun, Model 1920, M II, differs in many ways from the 14-inch, Model 1907. The breechblock, Wellin type, is supported by a block carrier. The carrier swings in a vertical plane about the axis of the hinge pin and carries the breechblock from the open or loading position directly into its seat in the breechblock, suitable clearance cuts are made in the breech recess to permit this. Two cam rollers are mounted on the rear end of the block. When the breechblock swings into the breech recess these rollers enter cam surfaces in the breech recess and control the movements of the block. The weight of the breechblock and carrier is counterbalanced by a spring so that the breech can be opened and closed by one man. The breech normally is operated by compressed air. An air cylinder containing a piston and piston rod—the latter being connected to a bracket on the carrier—furnishes the means of closing by air force. To close the breech all that is required is to raise the lever on the closing valve. The breechblock swings directly into the breech and rotates to locked position. Another device on this mechanism is called the air ejector. This device automatically blows air through the gun carrying any residue of powder bag or other burning material out of the muzzle before the breechblock is drawn out of the breech. This device prevents the danger of flarebacks sometimes experienced in earlier models. The firing mechanism is known as the Firing Lock, Mark I; it is provided with an insulated firing pin which fires the primer either electrically or by being struck by the firing hammer. Effective safety features prevent



**155-mm. Howitzer, T1—Breech Open.**

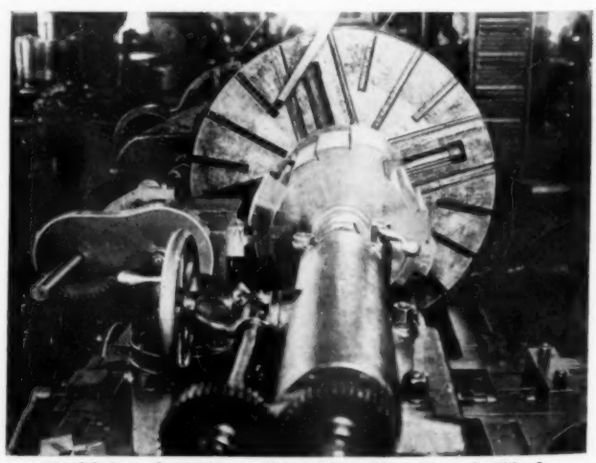
firing either electrically or mechanically until the breech is completely closed.

### 155-mm. Howitzer, T1

The breech mechanism for the 155-mm. howitzer, T1, is of recent design and incorporates some features not previously considered. The breechblock, Wellin type, is supported on a carrier hinged to the right-hand side of the breech. The hinge pin turns with the carrier and contains an arm on its upper end. A counterbalance spring is connected to this arm and balances the gravity force acting on the block and carrier when the breech is opened with the howitzer in elevation. The lever is connected to a crank shaft having two crank arms; one of these crank arms rotates the block and the other draws it and the obturator out of the gas check seat before the block swings out of the breech recess. This permits the use of a gas check seat of less abrupt angle than is the case where the block swings directly into the seat. The firing mechanism follows the same principle as the firing lock, Mark I, on the 14-inch breech mechanism, Mark II.

### Machining Operations on Breech Mechanisms

The machine tool equipment used in the manufacture of breech mechanisms consists mainly of commercial types. Some of the operations, however, require special modifications of the machines to develop certain of the geared motions and many special facilities such as jigs, fixtures, dies,



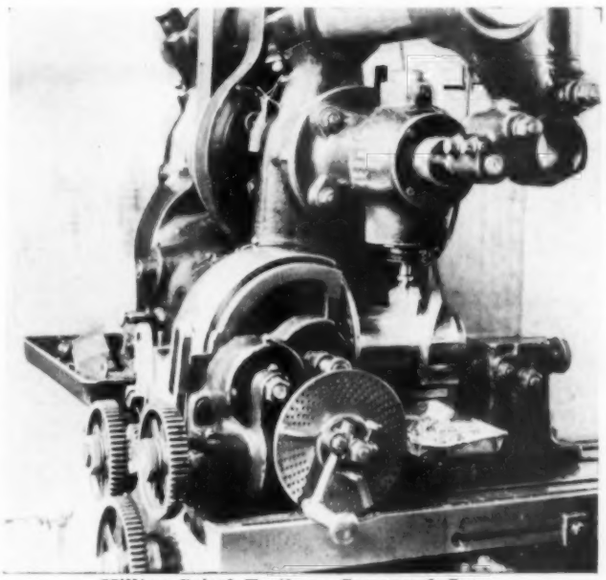
**Machining Operation, Step Threading Breech Block. 14-inch Breech Mechanism, Mk. II.**

**Milling Spiral Rotating Rack Teeth on 12 inch Mortar, Model 1912—Breechblock.**

form mills and other like facilities are used. One of the operations requiring a modification to the commercial engine lathe, for instance, is the stepthreading on the Wellin type breechblock. The modification to the lathe consists of replacing the compound rest slide with a housing, carrying a sliding tool-holder and a stepped cam. The cam is mounted on a splined shaft, geared at the head stock to rotate three revolutions to one revolution of the lathe spindle. The cam is divided into three cylindrical steps; the height of the steps being equal to the difference in heights of the threaded segments on the breechblock. One end of the sliding tool holder carries the thread tool and the other bears against the cam. The breechblock after being finished bored, faced to length and slotted to form the sectors, is placed on an arbor and rotates with the lathe spindle. When the thread tool is engaged in one of the three lowest segments on the block the rear end of the tool holder is bearing against the highest cylindrical step on the cam under pressure of a heavy coil spring. At the instant the thread tool reaches the small clearance cut separating the low segment from the one next higher, the highest step on the cam passes out of contact with the tool holder. The holder then jumps back against the next step on the cam and the tool enters the cut in the next higher segment on the block. After the thread tool has passed over the highest segment on the block the cam forces the tool in and over the blank segment on the block and the operation is continued without stopping the lathe.

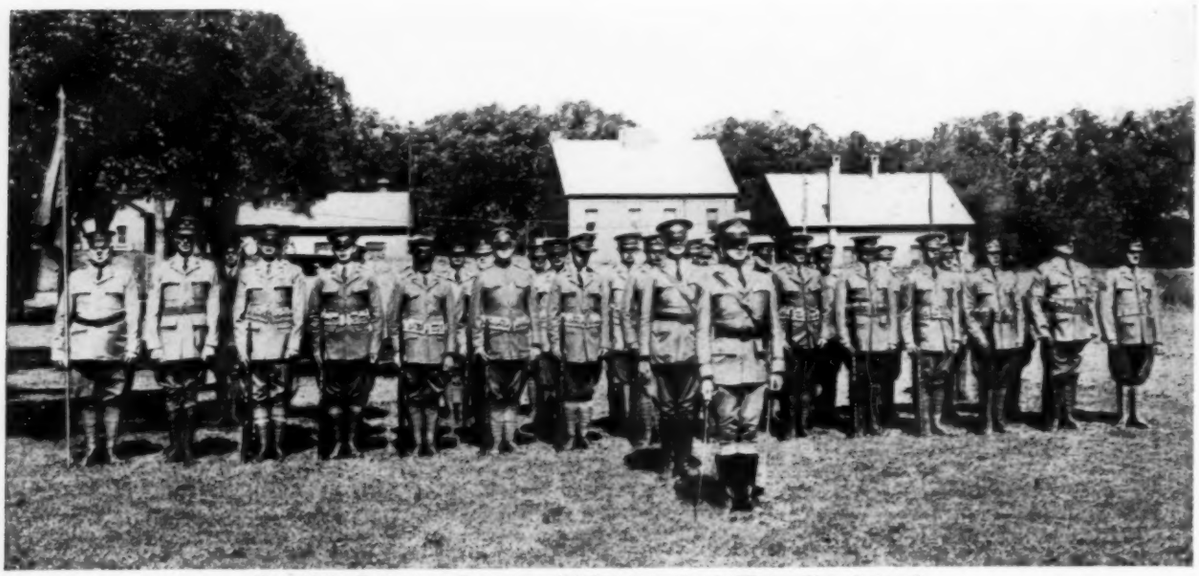
**12-inch Mortar, Model 1912, Dummy Breech Mechanism.**

The photograph of the 12-inch mortar, Model 1912, dummy breech mechanism with the breechblock partly withdrawn shows the spiral rotating rack and a portion of the translating rack on the side of the block. The compound gear is shown in engagement with the translating rack and, as will be noted, is a combination of spur and spiral gear. The location of the teeth of the two racks in relation to each other and to the threads on the block must be accurately established. The lead of the threads imparts a longitudinal movement to the block as it rotates about its axis, therefore, the centerline of the rotating rack is parallel to the threads instead of being in a plane perpendicular to the axis of the block. The equipment consists of an old type



**Milling Spiral Teeth on Compound Gear.**

boring machine, modified by attaching to the main spindle a bracket containing a motor driven spindle to hold and drive the tooth-forming milling cutter. The axis of the main spindle theoretically represents the axis of the compound gear and the end of the milling cutter is set at a distance from the axis of the main spindle equal to the radius of the compound gear. The breechblock is supported on an arbor on the table of the machine and is rotated about its axis by a train of gears driven from the main spindle. The arbor is threaded at one end to screw into the arbor support; this thread is the same lead as the threads on the block so that when the block rotates it also advances longitudinally to produce the required angle of centerline of the rotating rack. The rotation of the main spindle and that of the work is done by one handwheel mounted on a worm.



The 19th Ordnance Company (Maintenance) at Watervliet Arsenal.

# The 19th Ordnance Company at Watervliet Arsenal

Capt. T. W. Conrad, Ord. Dept., U. S. A.*

SINCE the establishment of the military post at Watervliet in 1813, there have existed at the arsenal various detachments of troops which corresponded in a general way to the present day ordnance company. For several years the troops stationed at this arsenal were mostly from the Artillery. An interesting document in the files of the arsenal shows, among other items, the issue, on October 17, 1818, of the following articles of clothing to the detachment then at the post: "9 private artillery coats, 6 pairs white woolen overalls, 7 pairs gaiters, 1 cap (leather), 1 cockade and eagle, 1 pompoon."

The early successors of this evidently colorful detachment were finally quartered in permanent barracks, the cornerstone of which was laid in 1843. This building, which in later years has been modernized, is now occupied as barracks by the 19th Ordnance Company (Maintenance), the present successor of the various detachments which have performed ordnance duties at this arsenal since 1813.

The 19th Ordnance Company (Maintenance) was organized on March 24, 1921, from the personnel of the ordnance detachment then on duty at the post and at first was composed of one officer and 48 enlisted men. Since that time the authorized peace-time strength has been reduced to one officer and 37 enlisted men. During the period of the summer training camps of 1927, a temporary increase of seven privates was authorized.

The peace-time allotment for the organization by grades, not including the temporary increase, is two technical sergeants, one staff sergeant, four sergeants, four corporals, eight privates, first class, and 18 privates. The allotment of specialist ratings by class is two first, two second, four third, two fourth, three fifth, and seven sixth. These ratings are distributed through the company for the various skilled trades which are required in the performance of the field duties prescribed for maintenance companies.

The company is divided into five sections as follows: headquarters and supply, service, artillery, automotive, and armory. This division is for the purpose of forming an organization which by training and experience will best accomplish the various functions of a maintenance company. The headquarters and supply section is for administrative work, and for issue and supply of equipment. The service section is composed of men who by training and experience are best fitted to perform the duties of carpenters, blacksmiths, electricians, leatherworkers, and welders. In the artillery section are placed men for instruction and experience in the care and maintenance of the 75-mm. field gun, the 3-inch antiaircraft gun, the 155-mm. howitzer, and the 155-mm. G. P. F. The men in the automotive section are charged with the upkeep of truck, tractor, motorcycle, and trailer equipment. Instruction and training in the armory section is for the proper care and repair of small arms. These sections necessarily require the training of men as clerks, machinists, and mechanics in addition to the trades named in the service section.

This trained personnel is obtained to some extent by special recruiting and by sending each year, five or more men from the organization to the Ordnance Specialists' School at Raritan Arsenal. Upon graduation from the school at Raritan, men are returned to the company and are then available to assist in the instruction of other

*Commanding 19th Ordnance Company (Maintenance), Watervliet Arsenal, Watervliet, N. Y.

men who have had little or no experience in any of the trades named.

The rifle is designated as the principal arm of the company and, during each season, the organization conducts target practice both with the rifle and the pistol. In one of the shop buildings, there has been constructed a range for gallery practice and there is also a pistol range on the post. For rifle practice, the company is allowed to use a very good range located at Rensselaer, N. Y., which is approximately seven miles distant. Transportation to and from the rifle range is afforded by means of company trucks and chauffeurs.

**The 19th Ordnance Company (Maintenance) and its Rolling Equipment.**

The rolling stock of the company is kept entirely separate from other motor vehicles belonging to the post and consists of three F. W. D. artillery repair trucks, two F. W. D. small arms repair trucks, six F. W. D. 3-ton cargo trucks, two Dodge light repair trucks, one F. W. D. tank truck, two motorcycles with side-cars, and one kitchen trailer. The road-space allowed for the column is 560 yards. The maintenance of this rolling equipment is one of the most important duties of the company and it requires considerable skill on the part of the personnel to "keep them rolling."

Since 1922, a detachment from the company has been sent each year to one of the summer training camps to inspect, repair, and maintain Ordnance material for the various organizations at the camp. In 1922, 1923 and 1924, a detachment was sent to Plattsburg Barracks, N. Y., for camp duty. During each of the last three years a detachment has been sent to Pine Camp at Great Bend, N. Y., for this duty. The detachment, each year, makes the trip to and from camp in company motor vehicles.

During the training camp season of 1927, one officer and nine enlisted men from the 19th Ordnance Company and three enlisted men from the 1st Ordnance Company at Miller Field, Long Island, N. Y., went from Watervliet Arsenal to Pine Camp, a distance of approximately 170 miles, with one artillery repair truck, one 3-ton cargo truck, two light repair trucks, and one motorcycle. Four of the enlisted men went on from Pine Camp with a light repair truck to Fort Ontario, N. Y., for duty at that station during the season.

At Pine Camp, the detachment withdrew from storage twenty-four 75-mm. field guns, twelve 155-mm. howitzers, and twenty-four 5-ton tractors and prepared them for issue to the various organizations later to arrive. After issue, the detachment inspected and maintained the 75-mm. field guns used in camp by the 7th U. S. Field Artillery, the Field Artillery of the National Guard of New York and of New Jersey, the R. O. T. C., the C. M. T. C., and the Organized Reserves. The guns were bore-sighted before issue and, during the firing, men from the detachment were furnished for necessary repairs and adjustments. Fire-control instruments were repaired and adjusted whenever necessary by an expert civilian sent from Frankford Arsenal who was attached to the organization in camp. The 155-mm. howiters and the 5-ton tractors of the New York National Guard were also cared for by the detachment.

The detail of four men at Fort Ontario helped to maintain the 3-inch antiaircraft guns, the 155-mm. G. P. F.'s, and the 10-ton tractors used at that station by the National Guard of New York.

During this summer camp work, the ammunition foreman and the ordnance machinists from the Second Corps Area headquarters were present and rendered valuable assistance by their experience and skill.

At the close of this typical summer camp season, the detachment returned to Watervliet Arsenal with the trucks and equipment used in camp.

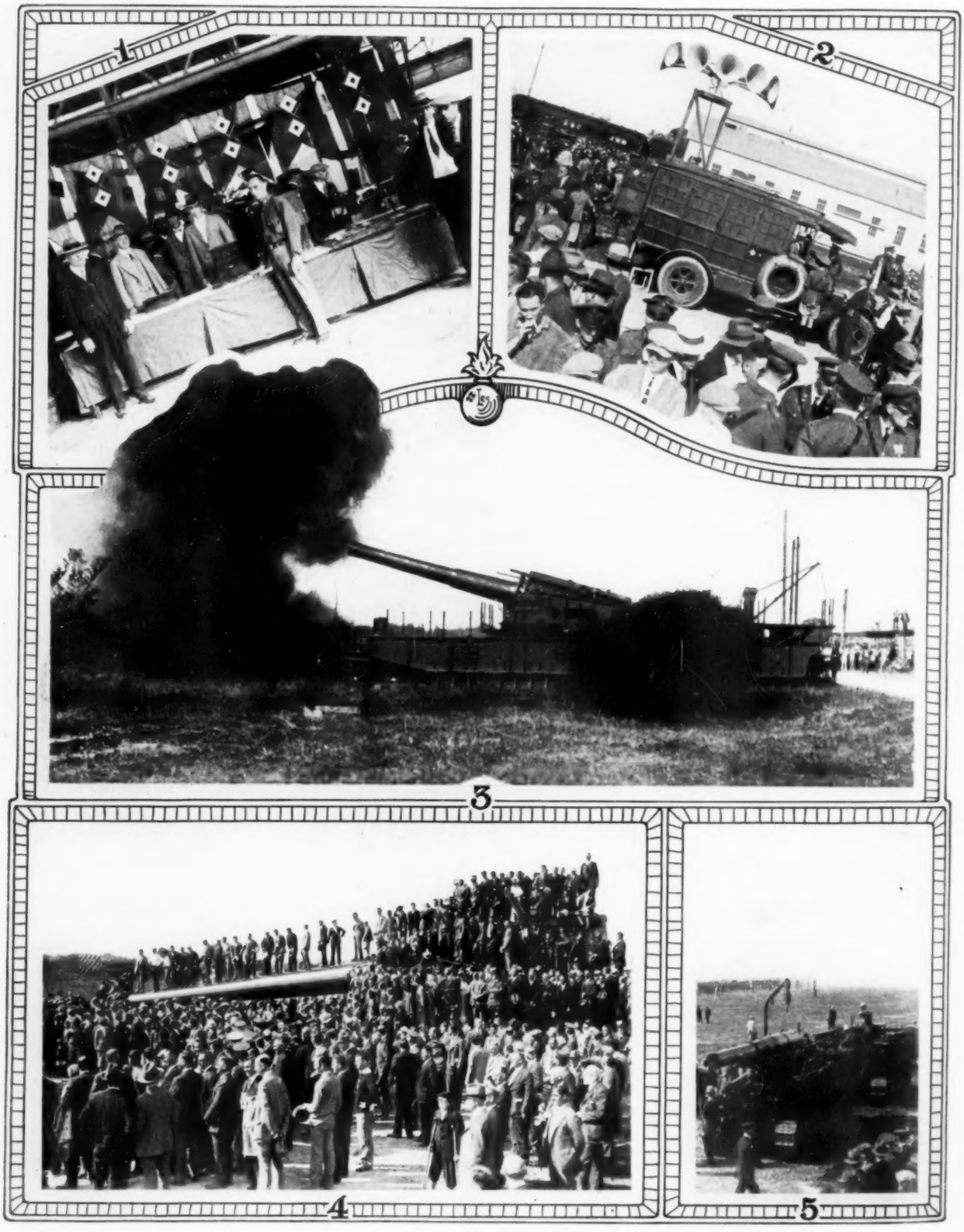
During the fall and winter season, the trucks and equipment used during the previous summer camps are given a thorough overhauling and placed in condition for future service. This is excellent training for automobile mechanics and machinists and all necessary machine work is done with company equipment.

During the winter months, instruction is also given on available matériel such as the 75-mm. field gun, the 155-mm. howitzer, the Browning machine gun, the automatic rifle, the Springfield rifle, and the automatic pistol. In general, this instruction covers the characteristics, operation, nomenclature, adjustment, assembly, and disassembly of these weapons which the company, if ordered into the field, might be called upon to maintain and some of which a detachment from the company does maintain during the summer training camp season.

The company owns and maintains a herd of cattle for supplying milk and obtains fresh vegetables and fruits, when in season, from the post garden and fruit trees. These additions to the mess together with the new ration allowance make it possible to maintain an excellent mess, both in variety and quantity.

Permanent quarters are available for all of the married non-commissioned officers of the company and there is a garage reserved for the use of the enlisted men owning automobiles.

The location of the post is such that both Troy and Albany are easily accessible and men when off duty are allowed to visit those cities. There is also a large amusement park nearby. The Hudson River is one of the boundaries of the reservation and there are several pools and lakes in the vicinity which offer facilities for swimming, boating, and fishing in the summer time and for skating in the winter time. On the post are opportunities for football, baseball, and tennis for men interested in those sports.




**Scenes at Ninth Annual Meeting of Army Ordnance Association at Aberdeen.**

(1) Signal Corps, U. S. A., exhibits of radio and other communications apparatus. (2) Mobile Public Address System of Signal Corps, U. S. A., used to announce details of various demonstrations on the program. (3) Firing the 12-inch gun on railway mount was a feature of the morning demonstrations. (4) A section of the visitors grouped about the 16-inch seacoast gun. (5) Scene on the main front during automotive and mobile artillery demonstrations.

# NINTH ANNUAL MEETING ARMY ORDNANCE ASSOCIATION

SOME said 10,000 people were there, others estimated 5,000. One guess is as good as another, so what have you? However many there were, it was a whale of a crowd and the Ninth Annual Meeting of the Association at the Aberdeen Proving Ground, October 6, 1927, goes down on the record as eclipsing anything of its kind. When five or ten thousand people—the difference of a mere 5,000 matters little—journey from all parts of the country to attend a meeting devoted to industrial preparedness you have ample proof that the ball is rolling and that this new fangled idea of preparedness has sold itself by its sheer logic and its undeniable appeal.

It was not long after the first glint of dawn, October 6th, that special trains began rolling into the Proving Ground. Freighted with executives and engineers of every branch of commerce they came from New York, Washington and Pittsburgh, while the regular trains from north, south, east and west brought hundreds from every neck of the woods. The big parade of visitors arriving by automobile started early too, and if the color and kind of license tags is any indication some of the boys were on the road a long while for a great many states were represented.

From all of which it can be assumed that when the program of demonstrations began at 10 A. M. with an address of welcome by Lt. Col. C. M. Wesson, Ord. Dept., U. S. A., Commanding Officer of the Proving Ground, the 32,000-acre reservation seemed to be holding just about its capacity.

And they were all there too. It would be easier to say who was not there. The President's cabinet? Five of them, Mr. Davis, the Secretary of War; Mr. Wilbur, the Secretary of the Navy; Mr. Sargent, the Attorney General; Mr. New, the Postmaster General; Mr. Jardine, the Secretary of Agriculture. The "Litle Cabinet"? Colonel MacNider and Mr. Davison, the Assistant Secretaries of War; Mr. Robinson, the Assistant Secretary of the Navy. The War College? Enmasse, staff, faculty, and students. The Army Industrial College? The same. Ranking officers of the Army and Navy? Mighty few of them missing.

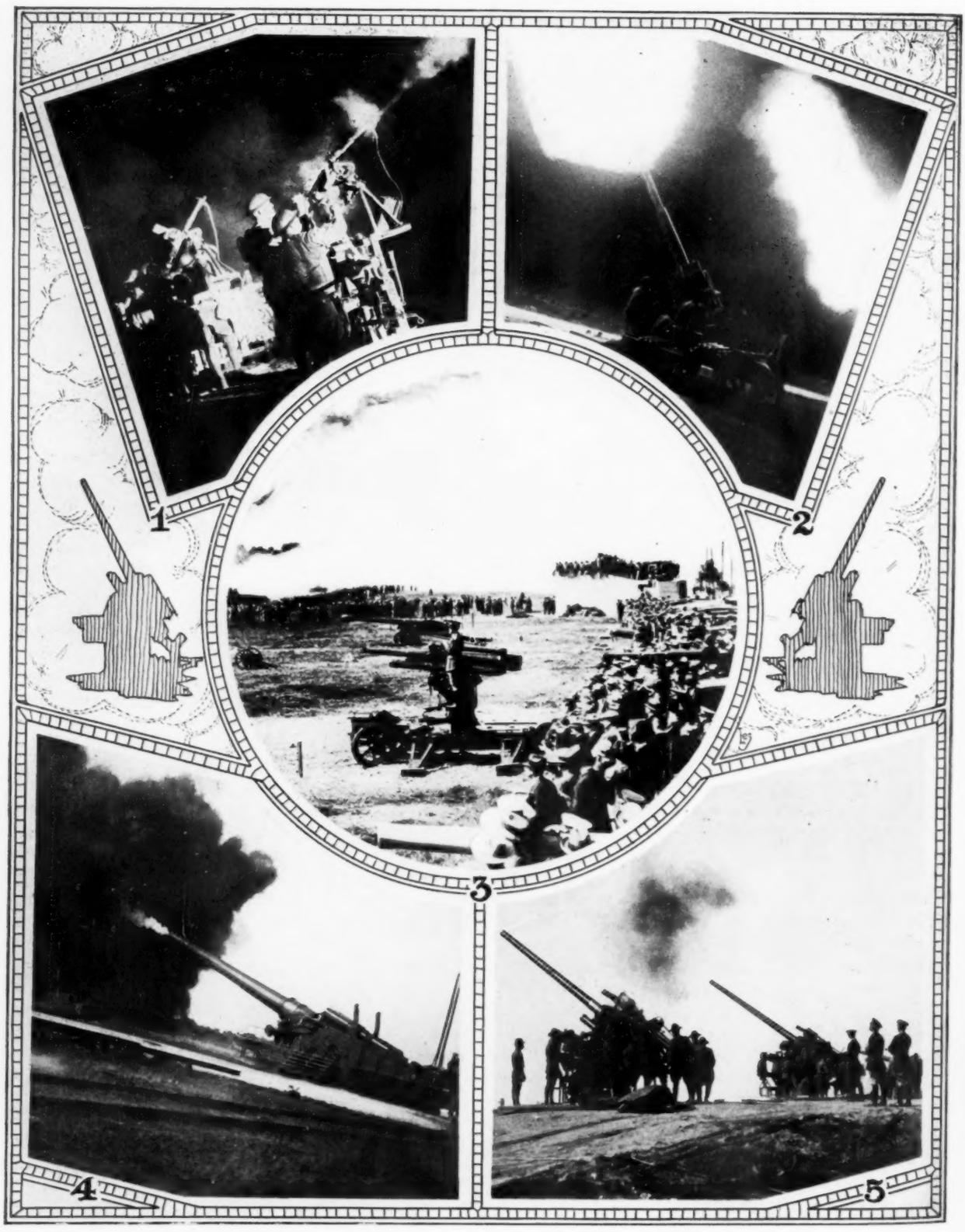
But even all of them were not a drop in the bucket. Few faces of members of the Army Ordnance Association were missing. Then there were contingents from the Society of Automotive Engineers, the American Society for Testing Materials, and the Military Order of the World War—organizations which had been invited to participate in our meeting. A whale of a crowd and then some!

The program itself was a dandy. It ran from 10 A. M. until after dark. It began with the maneuvering and firing the giant 16-inch gun, the pride of American ordnance. It came to a fitting climax when the last antiaircraft salvo at night shot down a towed target and sent the tiny sausage-shaped object fluttering to earth in the glare of the giant searchlights. The big proving ground, gray in the light of flares and searchlights, took on the atmosphere of the old ball park when the winning run goes over in the last half of the ninth. The cheers that went up from thousands of throats as the antiaircraft gunners put on this finishing touch were not unlike the applause of the fans when the game is put on ice.

And so, let it be said again, it was a great show. Certainly nothing more inspiring, taken all in all, has been seen since the days when the boys forsook the mufti in 1917-1918 and, swapping fountain pen and hoe for Springfields, learned the language of war. And there's just the point. Ten years ago there was no such thing as an annual meeting of the Army Ordnance Association. If there had been, that swapping operation would have been accomplished in a flash instead of in 18 months. There would have been guns and ammunition for all because American engineers and manufacturers would have known what it was all about. Today the shoe is on the other foot and, if interest in Army Ordnance as evidenced by this meeting is any criterion, it intends to stay there.

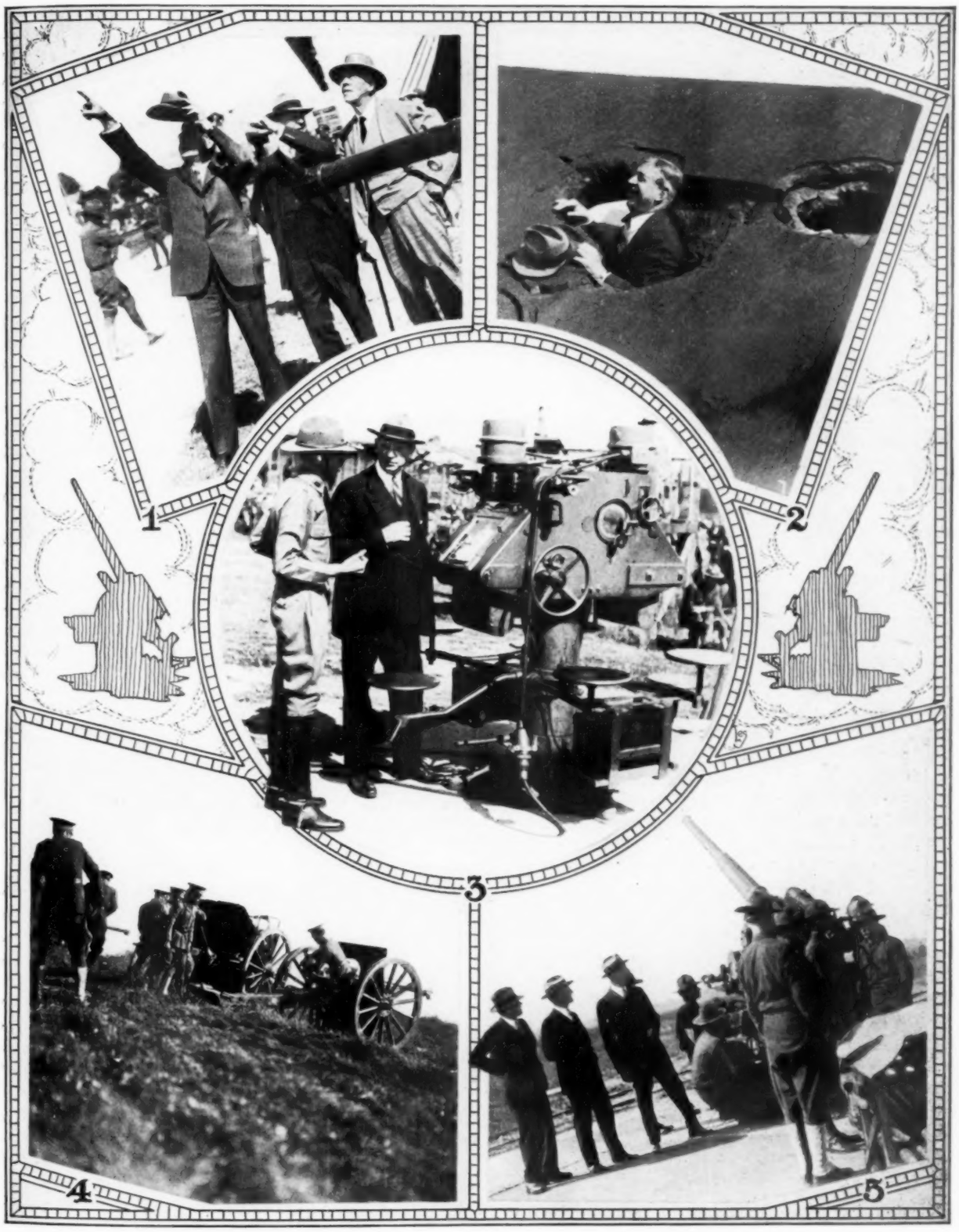
Rather than give our own impressions of the demonstrations let us quote those of a casual observer, typical of hundreds of the visitors. This from the *New York Times* of October 7, 1927:

"Aberdeen Proving Ground, Md.—The kind of war the United States will wage in the event of a national emergency was pictured in thrilling and spectacular fashion to thousands here today. It was the greatest artillery show staged on this hemisphere since the Armistice, beginning with the firing of the biggest gun ever constructed for the seacoast protection of the nation and concluding with a




**Guns—Big and Little—Perform at the Annual Meeting of the Army Ordnance Association.**

(1) Browning machine guns spouting tracer ammunition at the targets towed by airplanes at night. (2) Probably the most spectacular event of the program was the demonstration of antiaircraft night firing with the larger guns. (3) A view of the Main Front during the mobile gun demonstrations in the afternoon. (4) The huge 16-inch seacoast gun in the act of firing—this blast opened the program at 10 A. M. (5) A portion of the antiaircraft battery during the day firings. Long, slender and extremely business-like, these guns gave an excellent account of themselves.




**With the Distinguished Guests at the Ninth Annual Meeting of the A. O. A.**

(1) Curtis D. Wilbur, Secretary of the Navy; Dwight F. Davis, Secretary of War, and John G. Sargent, Attorney General of the United States, follow the firings of antiaircraft guns. (2) The Secretary of War inspects a huge piece of armor plate penetrated by armor-piercing projectiles. (3) The brains of an antiaircraft battery, the latest fire-control instrument for antiaircraft gunnery, is explained to the Secretary of War. (4) Realism of warfare was introduced in the program when Field Artillery troops from Fort Hoyle, Md., maneuvered and attacked a strong point. (5) F. Trubee Davison and Hanford MacNider, Assistant Secretaries of War, with Secretary Davis, examining an antiaircraft gun.

night demonstration by the antiaireraft command from Fort Monroe, Va.

"More than 5,000 persons, including most of the members of the Cabinet, the highest ranking officers of the army, navy and marine corps, and scores of prominent civilians, came to the Aberdeen Proving Ground by special train and in automobiles from New York, Boston, Philadelphia, Chicago, Washington and other Eastern and Midwestern cities to witness the show. They saw one they will never forget. Detonation followed detonation in rapid succession, ranging all the way from the ear-splitting, earth-shaking explosion of the 16-inch gun to the spitfire of machine guns of every modern type and caliber. The weather was ideal for the exhibition.

"The firing of antiaireraft guns at targets towed by airplanes was the feature of the night demonstration. Flaming tracer bullets, bursting shells, searchlights that played from every direction on the plane and targets, made the night picture one never to be forgotten.

"The climax came in the last round fired when the highest up of all targets was shot down by a battery of 3-inch guns. It was a wonderful piece of marksmanship that thrilled the onlookers.

"Every few minutes ten thousand fingers plugged ten thousand ears. Before the day was an hour old the admonition from the officers at the loud speakers, 'we advise our guests to place their fingers in their ears,' brought a laugh, for half of the audience had done this even before the announcement.

### Post-War Guns Displayed

"Many of the post-war guns were seen by the general public for the first time. One of the new ones that attracted great interest was a 4.2-inch mortar, designed and perfected by the Chemical Warfare Service of the Army. The new gun is intended to destroy machine gun nests which can be reached and soldiers manning them gassed even when operating at a distance of more than a mile and one-half from the mortar from which the gas-filled shells are fired.

"Almost as interesting were the new types of antiaircraft guns. Whether they have an effectiveness comparable to the chemical mortar is a moot question. The concensus of opinion among the civilians, at least, seemed to be that antiaireraft artillery development still has a long way to go before it masters the mile a minute bombers and scouts against which it is designed to operate.

"The spectacle, so far as the crowd was concerned, was not unlike a championship golf match. There was the gallery such as when Bobby Jones defends his crown, but with this difference: The golf enthusiast tramps along for eighteen holes and if the game starts early he can have lunch at home. Today one had 35,000 acres, or nearly fifty-five square miles, to negotiate if he saw everything.

"The gallery today represented, it seemed, every walk in American life. The military and naval attachés of foreign embassies and legations, most of them in the field uniforms of their respective services, were present, and on all sides were the insignia of every rank and every arm of the defense services of this country.

"Some of those present even brought their children. One budding second lieutenant of infantry showed up with his baby boy in his arms. This man stood within twenty-five yards of the 16-inch coast defense gun when it was fired. He jumped when the shell started on its screaming way seaward, but the baby did not so much as bat an eye. A platoon or more of army dogs seemed unconcerned no matter how ear-splitting the racket.

"The first number on the program was the firing of the mighty 16-inch coast defender. Enlisted men on police duty courteously pushed the crowd back beyond the danger line. There was a blast of a shrill whistle. It was the first warning. A few seconds—they seemed minutes—passed and then it came, a terrifying roar and a great cloud of bluish black smoke that slowly took on a yellow hue.

"The shell which had it been aimed in the direction of Baltimore would have crashed into the heart of the city, screamed like a living thing, a whining kind of sound, rapid cessation of which indicating the terrific speed with which the 2,300-pound projectile was making through the air.

"This gun of which there are now thirty-two in the army and navy, can be fired at one-minute intervals and the one discharged today represents the last word in the improved type of this long-distance engine of destruction.

"Secretary Davis of the War Department was with the officers commanding the gun personnel. As the echoes died away in the marshy wilderness to the east, he extended his congratulations to the gun crew. He had witnessed the firing of one of the deadliest things ever conceived by man.

"Ten minutes after the smoke of the 16-inch gun disappeared came the next number, this time the firing of an 8-inch navy type rifle on a railway carriage. This is also a post-war development in that the railway carriage was originally designed to mount a 12-inch howitzer. It hurls a 200-pound projectile a little over nineteen miles but makes almost as much noise as its big 16-inch brother, which can send its huge missiles thirty miles.

### 12-inch Gun Railway Mount Fired

"Next came a 12-inch gun also mounted on railway carriage, the range of which was about sixteen miles and hurls a projectile weighing 700 pounds.

"These railway mounted guns can be transported to any part of the coast line reached by railroads and can be fired at angles up to 38 degrees without loss of range. These guns in the event of war would be part of the backbone of the coast defense.

"Next were the antiaircraft tests. They were spectacular and the ordnance officers insist they were successful, but to many laymen who witnessed these demonstrations in which various types of antiaircraft guns were brought into play it seemed that the airplanes had all the best of it.

"There were three targets each towed by a scout plane, each target about twenty-seven feet long and five feet wide. It was a stocking-shaped affair made of canvas with one end hooped and open and a small aperture in the toe. It was a lurid red and was towed about 1,200 yards astern.

"The only delay in the program came during the tests of the antiaireraft guns. This was due principally to the leisurely way in which the aviators maneuvered into position. The first attack was set for 10:30 A. M., but it was fifteen minutes later when the target came into the zone of fire.

"The plane was speeding nearly 100 miles an hour and the big red canvas target looked like a giant frankfurter sausage. As the new 3-inch guns opened fire, they made a terrific racket and it was easy to follow the course of every shell, the first forming a tiny snow white cloud high in the air. Each shot viewed from the earth apparently missed the target. At least when the burst showed the red stocking appeared well outside the danger area.

"Five minutes passed and the target was once more in the line of fire. This time the antiaircraft gunners used a 37-mm. Browning. The tracers showed all about the stocking and as subsequently developed many of the bullets pierced the canvas bag. Once more the target was towed into the safety zone, but in a few minutes it was back again and again the noisy, teasing three-inchers were brought into action.

"Now came a test in which the machine was more than two miles in the air, so far up that it appeared but a speck. The target was barely visible. The gunners used the 105-mm. weapon which fires a thirty-three-pound projectile and attains a vertical range of eight miles, while its horizontal range is nearer eleven miles.

### 105-mm. Antiaircraft Guns Fired

"The din was deafening as the battery of 105s opened fire. The bursts, great snow-white spots in a perfectly clear sky, were one of the most beautiful sights that showed in the skies here today.

"The antiaircraft feature of the day ended with the dropping of two demolition bombs by giant bombing planes. They were of the 600-charge type. One exploded under water. A huge column of water that looked as big as the Woolworth Building was hurled into the air and, falling, resembled a vast fountain. The other shell exploded just before it struck the water surface. It made a lot of fuss, but there was not the beautiful aftermath that followed the underwater detonator.

"When the airplane targets were inspected after the tests it was announced that all three had been punctured by shrapnel, but at what heights is apparently not known. There were fourteen holes in one, fifty-seven in another and thirty-eight in the third target. However, the civilian verdict still went to the planes, for the argument of the man in the street was that in time of war the last thing an enemy plane would do would be to maneuver into the fire zone of an antiaircraft battery.

"Then there was the laying of smoke curtains by planes high in the air. The smoke completely obliterated from vision everything for miles on either side. Next came a mustard gas "attack." Had the gas been real few would be telling the story of Aberdeen tonight.

"After the smoke and gas number was staged another thrilling spectacle, the famous 75-mm. gun, had the leading part, and tanks of all sizes and degrees, mortar batteries, infantry howitzer batteries and 37-mm. guns were some of the other weapons featured.

"Not since the Civil War has there been heard in Maryland such a racket as marked the progress of this sham battle. There was so much smoke that it seemed as if all the country hereabout was on fire.

"It was the night part of the big demonstration which from a standpoint of the spectacular proved to be the star number of the program. It was entirely an aerial spectacle, a wonderful combination of tracer bullets, bursting shells, giant searchlights, the dimly illuminated airplanes and the 'stockings,' which showed white tonight as they swept into the fire zones.

"The great show ended when a shrapnel shell from one of the new 3-inchers broke the tow line and brought the target hurtling to the earth. At the time the target was one and one-half miles straight up, but two and one-half measured by the horizontal line of fire. It was a wonderful sight.

"The tracer bullets from the new Brownings showed brilliant red and one could trace the course, it seemed, of every one of the hundreds of bullets as they sped on their journey in search of the 'stocking.' In the meantime the target was caught by six great searchlights. It showed in the lower altitudes a big silver sausage-looking thing, in the dizzy heights a silvery speck under the stars.

### Night Firing Most Successful

"Ordnance officers declared the night tests among the most successful ever made by the army. It should be pointed out that the gunners knew the exact altitude at which the targets were towed, they had the speed of the airplanes, while the searchlight operators had no great trouble locating the targets, knowing as they did the exact distance they were astern of the red-lighted machines that had them in tow.

"But all this does not detract from the meritoriousness of the achievement. It was something that happens very seldom and tonight it happened in the presence of thousands of cheering people. The target was still slowly falling earthward as the special trains began pulling out."

Suffice it to say the officers and staff of the Proving Ground did a great job—as did contingents from the other branches of the Army, the Coast Artillery, the Field Artillery, the Infantry, the Quartermaster Corps, the Chemical Warfare Service, the Air Corps and the Corps of Engineers.

At the business meeting of the Association in the afternoon at which Mr. Benedict Crowell, President, former Assistant Secretary of War and Director of Munitions during the World War, presided, addresses were made by the Secretary of War, Mr. Davis, and by Assistant Secretaries MacNider and Davison, Hon. Swagar Sherley, Chairman of the House Appropriations Committee during the World War, and Maj. Gen. C. C. Williams, Chief of Ordnance, U. S. A. All the speakers emphasized the urgency of adequate industrial preparedness and praised the work of the Association.

Despite the excellent cooperation of the Quartermaster Corps, the meal arrangements proved entirely inadequate—one member referred to them as the bull ring method of feeding. But, kind friends, when you stage a party for say 3,000 and anywhere from five to ten thousand show up even a banquet hall begins to look like a bull ring and Oscar himself might tear his hair trying to do his best. Let it be said, however, that we live to learn and already ways and means are being studied to iron out the few wrinkles and next year's meeting—meals and all—will go like clockwork.

# Among The Victors at National Rifle Matches Camp Perry, Ohio, September, 1927

(Right) Regular Army Infantrymen keeping exact record of scores during National Rifle Matches. The scorer, who is seated immediately behind each competitor, records each score which is checked with the shooter's own record and that kept in the pits.

(Below) Firing like the 6th Engineers at Cambrai who dropped their pickaxes for rifles and by cool shooting stopped the enemy advance, Lieut. Albert L. Lane, Corps of Engineers, U. S. A., made a new record in the President's Match of the National Rifle Matches at Camp Perry when he turned in a perfect score.

(Above) The new rifle champion of the United States, Lieut. R. M. Cutts, U. S. M. C., winner of the National Individual Rifle Match at Camp Perry. Scoring 292 out of a possible 300 points the champion won his laurels against a field of 1,436 competitors.

(Left) Although these gobs are dressed as soldiers the fact remains they are regular members of the U. S. Navy. They are grouped around the Herrick Trophy which they succeeded in capturing from the Army and Marine Corps at the National Rifle Matches.

# Editorial

### "Practical, Realistic, Hardboiled"

BY permission of the Managing Editor of the *New York Sunday News* we publish the following editorial which appeared in that paper, October 16, 1927:

"Pacifists, emotionalists and idealists are engaged in sending up the screams which customarily follow the annual war games of the Army Ordnance Association at the Aberdeen Proving Ground in Maryland.

"More than 5,000 people saw this year's show. The exhibition began with the firing of a 16-inch coast defense gun which can throw a 3,300-pound shell thirty miles. An antiaireraft test, wherein three-inch guns spat steel at red canvas targets which trailed scout planes like giant flying hot dogs, kept the spectators' mouths open and eyes a-pop for an hour or so.

"Much money was shot away in the form of powder and metal. The pacifists would like to know to what purpose.

"The answer to that is that another war is not beyond the bounds of possibility; and that the Army Ordnance Association is one of the few practical, realistic, hardboiled groups in the country to recognize the fact.

"In the Association are manufacturers, engineers, business men, army men. They have been meeting at Aberdeen one day in each year since the war. The war games keep the manufacturers and business men posted on the newest developments in big guns, machine guns, explosives, technical methods.

"A member who makes tin cans in peace time say, knows that in war time he could turn his factory to production of shell forgings. He knows how he could do so, and how quickly. He did not know in April, 1917, because no one had ever told him and the War Department had griefs of its own to wrestle with.

"You may hate the thought of war. Most people do. But if we ever have another war, we'll be thanking heaven for the Army Ordnance Association."

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### Sound Preparedness Philosophy

HON. SWAGAR SHERLEY, former member of Congress from Kentucky, was one of the speakers at the Ninth Annual Meeting of the Army Ordnance Association. All of us will recall Mr. Sherley's preeminent work during the World War as head of the Appropriations Committee of the House. If a digression may be permitted in this connection, let it be said that probably no more significant tribute has been paid Mr. Sherley than that of Brig. Gen. Herbert M. Lord, director of the national budget, in a recent address when he said, "Following the Armistice brave effort was made to demobilize the swollen Federal service, to reduce the appalling expenditure and to check the rising debt. The first, and one of the most important steps in the direction of national saving was made by Congress under the lead of Representative Sherley, of Kentucky, chairman of the Appropriations Committee, during the Wilson administration. Billions of dollars in the hands of the war-making and allied agencies of the Government at the close of the war were available for expenditure. The danger of waste of some of these colossal sums were very real. Mr. Sherley, alive to the danger, attacked the problem promptly and courageously. He took from the holding departments and bureaus more than seven billions of dollars cash and put them back in the Treasury. He took away from the war-making agencies contract authorizations in excess of eight billions, which if left undisturbed, could have been transformed into actual obligations. The amount involved was in excess of fifteen billions of dollars—the most extraordinary recovery of public funds in history."

This in addition to the fact that during actual hostilities Mr. Sherley led the forces in Congress in appropriating the billions needed for defense. Certainly this man must have a conception of preparedness equalled by few others.

In his Aberdeen address Mr. Sherley stressed the need for preparedness—industrial preparedness—during the piping days of peace. "In my judgment," he said, "no more important work can be done than to bring the industrial energies of America into close, intimate contact with the Army and its personnel so that when war does come we may have industrial capacity for output somewhat appropriate to our needs. The Government ought not undertake to have the manufacturing capacity of its own arsenals sufficient to supply our needs in war.. It ought only have that capacity that will acquaint its officers. But the civilian population should be so mobilized and trained and so equipped that it would be able upon short notice to give to the country that matériel needed whenever we go to war.

"We are in the slack days. War is getting far enough behind for many of its lessons to lose their effectiveness. It requires such an organization as this to keep alive the interest and realize the responsibility that will enable America to go into our next war if we must go—and we all pray God we may not have to—better prepared than ever before."

Here is sound, practical philosophy for you! And it comes from a man who, probably more than any other, was responsible for the O. K. when we were spending a million dollars an hour for preparedness in 1918. He knows, just as every one else does who stops to think about it, that an ounce of prevention is worth a pound of cure, that the brotherhood of man is great stuff as long as all the brethren act brotherly. He knows, just as every one else does, that after an accident happens is not

the time to think about taking out an insurance policy. Those of us who look at life as it is and not as it should be are "hardboiled," perhaps, but until we can be shown a better doctrine than the old homely axiom of experience being the best teacher we'll stand by our guns—figuratively and literally.

### Another Milestone

THE Ninth Annual Meeting of the Army Ordnance Association has come and gone. Just as its predecessor was the biggest and best ever and the one before that likewise, so the ninth walked off with honors in great fashion. The how and why appear elsewhere in this issue.

Nine years and going bigger and better than ever! Think of it! Has this idea of industrial preparedness passed the test of time? Nine years isn't a whole lot as things go. But it should be sufficient for an idea to sink in, get milled around a bit, and survive or perish on its merits. And it has not only survived, it is flourishing—the passing of each milestone on the way shows it looming up in greater importance as we go.

They say there's a sort of charm about going into two figures. Next year will be the tenth. A trail has been blazed in the first decade that augurs well for the years to follow.

### Watervliet Arsenal

AS one reads the several articles in this issue the importance of the Watervliet Arsenal in our modern scheme of national defense is apparent. Watervliet is the lone Army establishment where larger caliber guns are made. That in itself is a mighty important role to fill. How well the facilities at Watervliet are utilized and the degree of skill possessed by its personnel can be visualized clearly. It is an assuring circumstance to know that this country has in its service officers and civilians skilled in the art of gunmaking of the ability and devotion of the Watervliet personnel.

In a broader way the importance of Watervliet as the repository for the knowledge and science of gun construction is even more significant. Commercially, gunmaking is something of a lost art; there is less parallel between it and any peace-time product of industry than there is for any other item of fighting equipment embraced in the term ordnance. That this establishment should lay fitting emphasis on the importance of keeping alive its knowledge and practice so that it can enlighten others in time of emergency is a function of transcending importance. Watervliet is alive to its responsibilities in this respect and is doing yeoman service. It is a worthy exponent of an art which caters to an erratic market—either the demand is tremendously great or it is ridiculously small. Should the peak demand come again Watervliet can be looked to, as in the past, to educate the nation in the art of gun construction.

### Rights and Duties

AS in all affairs of human conduct so in the matter of the national defense there is the immutable correlation of privileges and responsibilities, the complement of rights and duties. It goes without saying that if an individual is required to serve his country in time of war, a patriotic duty which men everywhere and from time immemorial have embraced with alacrity and devotion, there is the corresponding inherent right in the same individual to the assurance that every possible means is used by his country to train and equip him, to provision and shelter him, to protect and defend him. Oftentimes the country he defends is ill prepared to grant this assurance. Public sentiment may be the cause of such a condition or an absolute lack of physical resources may be the reason. It would be interesting to recall the conditions of our own campaigns from the days of Valley Forge to the present! But our concern here is apart from the responsibilities of the country to its defenders individually, rather let us consider the common defense in the aggregate and particularly the rights and duties of that class which must be depended upon to produce the sinews of war when occasion demands. A very definite duty rests upon them while they, in turn, are vested with a right which is just as definite. In other words, upon the American engineer and manufacturer rests the duty to do whatever he can to the best of his ability for the defense of the nation in time of war and at the same time he has the right to know what will be expected of him at such a time in order that he may the more successfully and the more efficiently perform those duties.

We have in America today a new theory of defense as different from the old as the open discussion of our present day judicial process differs from the star chamber proceedings of another age. The day of compulsory military service is gone and with its passing the duty of voluntary service—whether it be on the battlefield, in home or in factory, has advanced correspondingly. We have evolved the theory based on experience that defense of the homeland is no longer the responsibility of one group of citizens but that it is the common obligation of all, distributing its burden as equitably as possible upon all and dividing its privileges, such as they are, share and share alike.

This new theory has many radical differences from the old but possibly none is more apparent than that relating to munitions production. The old day of extreme secrecy has passed; the military authorities are anxious—they are required by law—to align the commercial industry of the country toward the expeditious production of munitions in time of war. The characteristics of our adopted armament are no longer a closed book and this is so primarily because the closed-book method has proved its own fallacy. In 1918 American industry did its best to meet the huge demands for munitions—a commodity it knew next to nothing about. It did a good job considering the handicaps but it took the huge facilities of America more than a year to hit their stride. Had this now recognized theory of mutual rights and duties been in practice the story would have been a far different one. The producer has a plain duty but, by the same token, he has a plain right. His duty is to do what he can, his right is to know what he will be called upon to do and how to do it. Happily for the safety of America—and we hope for the peace of the world—this status of mutuality is meeting with seemingly great success.

It is a very happy state of affairs and is fraught with tremendous and far-reaching possibilities for continued safety and peace.

# Personnel

### Training Reserve Officers in the Second Corps Area

STARTING from Miller Field, Staten Island, New York, on August 1, 1927, the 303rd Ordnance Company (Maintenance) of the 78th Division, together with the 302nd Ordnance Company (Maintenance) of the 77th Division, the 393rd Ordnance Company (Maintenance) and the 405th Ordnance Company (Heavy Maintenance) of the XII Corps, Fourth Army, commenced their 14 days of active duty attached to the First Ordnance Company (Maintenance) of the First Division, Regular Army.

The convoy consisted of 22 ordnance repair trucks and while this was not war-time strength of an ordnance company (maintenance) it was sufficient to train all attached officers and familiarize them with the difficulties which arise and which of course must be overcome quickly and efficiently in an emergency.

The convoy pitched camp on the first stop in the grounds of Raritan Arsenal. We had our field kitchen along and all meals were prepared by the company cook of the First Ordnance Company and his assistants. Our mess was not just good, it was excellent.

During our stay at Raritan Arsenal, we were instructed in the care, inspection and repair of artillery. While Capt. John Huling, Ord. Dept., U. S. A., who was the instructor in artillery at the Ordnance Specialists' School at Raritan Arsenal, gave the officers an outline talk on all calibers of artillery from the 37-mm. gun, up to the 240-mm. gun and explained the salient features of each, he concentrated his efforts of instruction on the 75-mm. gun. We spent two days actually dismounting, learning the nomenclature of and assembling the 75-mm. gun as well as doing considerable collateral reading. We would indeed be ungrateful if we did not express our thanks to Captain Huling for the knowledge he imparted to us and to Major Henry B. Sayler, Commandant of the Ordnance Specialists School, for his efforts to make our stay at Metuchen not only pleasant, but profitable.

We broke Camp at Raritan early August 5th, and made our way across New Jersey, over the Delaware River at Trenton, on down the Pennsylvania shore to Frankford, arriving there in the late afternoon. Lieut. Col. George L. Wall, Ord. Dept., U. S. A., Commanding Officer of Frankford Arsenal, assigned a very comfortable building to the officers for quarters and the enlisted men of the company were quartered in the recreation hall on the arsenal grounds. This was the only place where the enlisted men occupied buildings for quarters. On all other stops they were quartered under canvas. Saturday at Frankford Arsenal was spent in making a very instructive trip through the small arms ammunition plant.

The following day we were instructed in repair and maintenance of range-finding and fire-control instruments; visited the sound detecting instrument laboratory, and watched a practical demonstration of sound detecting instruments. A tour was made through the various artillery manufacturing shops, as it was possible for us to see artillery ammunition manufactured and have each step in the manufacture explained to us by arsenal personnel. The various manufacturing plants at Frankford Arsenal are organized in a modern way. Production and economy in manufacture is the keynote of each shop.

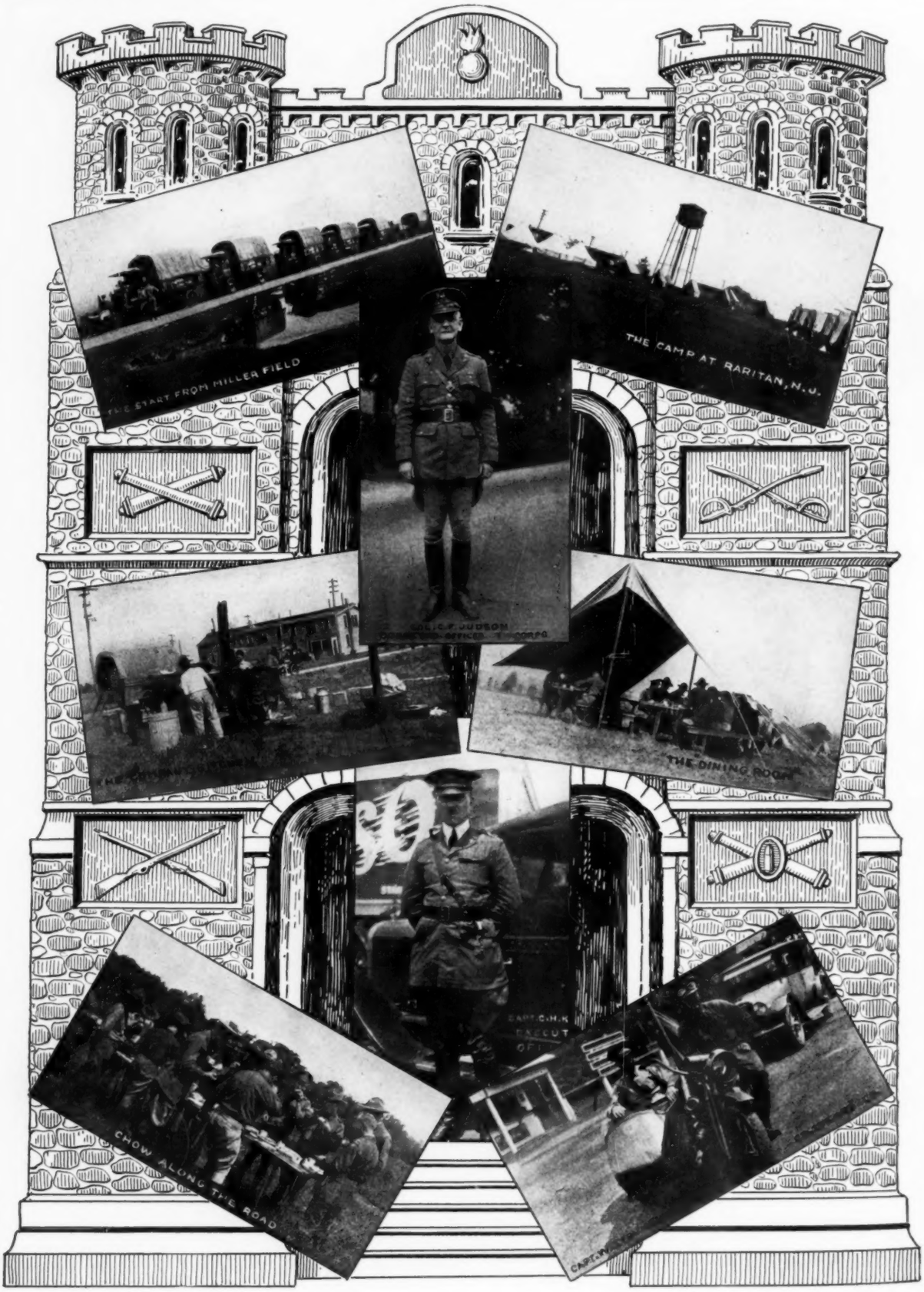
Leaving Frankford Arsenal early August 9th, we arrived at Easton, Penn., at 3:00 P. M. The city authorities of Easton permitted us to establish our camp on the athletic field adjoining the high school.

Early in the morning of August 10th, we broke Camp at Easton and continued our trip to Picatinny Arsenal. During our trip across New Jersey, reconnaisance was made within the area quandrangle 1:62,500, map Lake Hopatcong, preparatory to handing in our solutions of a map problem. Arriving at Picatinny about 3:00 P. M. the remainder of the day was spent in working out our solutions. In the evening a critique of the problem was held by Col. Cyrus F. Judson, Ord. Res., U. S. A., which was very beneficial to the potential division ordnance officers. This part of the training was enthusiastically received by the reserve officers, and while many glaring errors occurred in their solutions, the critique brought out these errors and it was fairly certain they will not be made again.

Two days were devoted to instruction in the manufacture of smokeless powder, and tetryl; the present status of high explosive for detonators and boosters; bursting charges for bombs, high explosives and grenades; melt loading, pellet loading, booster, detonator and fuze loading; propellant loading and complete round assembly. There was a talk on storage and surveillance of powder and the surveillance chamber was visited. A description of the various tests and the significance of each was given by Dr. Hale. A lecture and practical demonstrations were given on the destruction of ammunition and explosives. During the trips through the various manufacturing buildings, each step in the manufacturing process was adequately explained by a representative of Maj. J. K. Crain, Ord. Dept., U. S. A., Commanding Officer of Picatinny Arsenal. Surely these two days of instruction have made us all have more respect for the fact that powder and ammunition must bo properly stored and cared for if they are to be of any use in an emergency.

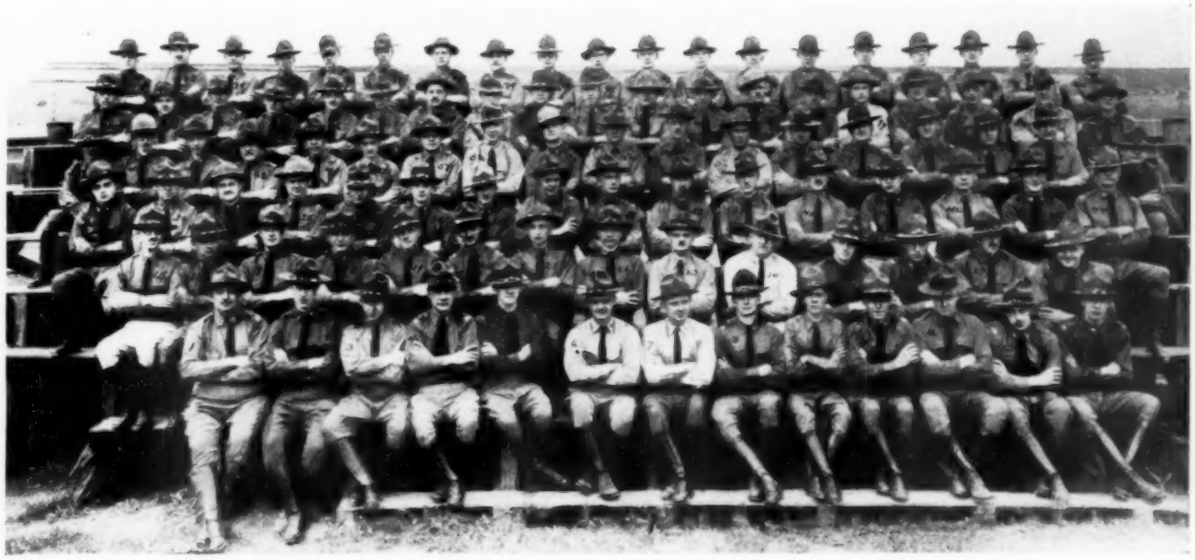
The return trip to Miller Field was made August 13th, and added materially to the experience which all ordnance company officers should have. The handling of a convoy on the road is no small job. More things can happen than any of us could possibly conceive.

In summing up the results of this active training period, one cannot help but be impressed with the fact that the experience these students obtained is the kind necessary




*Designed by P. Sebelmeier*

**Scenes During Active Duty Training of Reserve Officers of Ordnance Maintenance Companies of the Second Corps Area, August, 1927.**



**Reserve Officers' Training Camp, Aberdeen Proving Ground, July 31 to August 13, 1927.**

Front row, left to right: Capt. H. T. Chapin, Lt. L. B. Rosseau, Capt. R. J. Johnson, Capt. Frank N. Sarber, Lt. C. R. McCullough, Maj. C. H. Bandholtz, Ord. Dept., U. S. A., Capt. H. L. Campbell, Ord. Dept., U. S. A., Capt. W. B. Sidney, Lt. R. J. King, Capt. K. I. Tredwell, Maj. J. Lee Hughes, Lt. A. W. Teale, Lt. Ralph S. Nagle; second row: Maj. R. S. Hoar, Lt. J. A. Llompart, Lt. R. O. Huddleston, Lt. D. H. Reed, Lt. R. C. Ashworth, Jr., Capt. D. A. Lenk, Capt. B. F. Baker, Maj. L. E. Briggs, Capt. W. D. Smith, Capt. N. C. Avery, Lt. J. B. Stern, Lt. Chas. Clauss, Lt. C. J. Gibbs, Lt. J. F. Carroll; third row: Lt. H. A. Light, Lt. H. E. McKeen, Lt. W. M. Jahn, Maj. H. F. Martin, Lt. E. de Castro, Lt. A. B. Colwell, Lt. E. G. Shower, Col. J. O. Johnson, Capt. W. B. Williams, Lt. Donald Lamb, Lt. Seth Wiard, Lt. P. J. Klaseius, Lt. W. L. Emerson, Lt. T. R. Snyder, Lt. G. B. Jarrett, Maj. C. A. Wendell; fourth row: Lt. B. D. Roddey, Lt. F. P. Webster, Capt. S. L. Goodale, Col. F. H. Wagner, Maj. W. G. Golden, Lt. R. J. Fee, Lt. Joseph Proske, Lt. J. F. Lacchia, Lt. L. A. Lefcort, Lt. R. S. Haggard, Maj. M. G. Gallimore, Lt. J. B. Hoon, Lt. C. J. Galligher, Capt. C. R. Yates, Lt. E. B. Rumble, Lt. H. Barrows, Lt. G. O. Stuart; fifth row: Capt. Stanley Dewsnap, Lt. Nathaniel Ely, Capt. C. K. Shedd, Lt. F. A. Hennigan, Lt. V. J. Eaton, Lt. L. M. Wolford, Maj. A. M. Platoff, Lt. E. E. Wilson, Lt. A. H. Nordstrom, Lt. C. G. Miller, Lt. Richard Kent, Maj. J. D. Murray, Lt. A. J. Schwartz, Capt. J. C. Karnes, Lt. E. R. Melton, Lt. E. M. Byrne, Capt. P. L. Alger, Maj. Harry Hoisington, Lt. C. F. Schell; sixth row: Maj. E. R. Moody, Lt. C. L. Hager, Jr., Lt. L. C. Ensminger, Lt. E. W. Eddy, Lt. B. P. Young, Lt. J. J. Hanaw, Lt. R. J. Carper, Lt. N. E. Sill, Lt. H. R. Couch, Lt. H. E. Smith, Lt. A. E. Ryon, Lt. E. A. Gafvert, Lt. A. E. Warren, Lt. C. E. Herrstrom, Lt. V. C. Pritchett, Lt. Sidney Reed, Jr., Lt. K. V. Castle, Jr., Maj. G. A. Voss, Lt. A. G. Glode.

to make them better officers. While of course the conditions under which the trip was made are vastly different than during an emergency, nevertheless by actually observing and learning how to correct the difficulties that arose and having the advice and counsel of experienced regular Army officers on these difficulties, they were able to make themselves more valuable than they possibly could by the correspondence school method. No implication is meant that the correspondence courses are not valuable. On the contrary, they are most valuable, but they should be augmented by practical training.

It would be remiss not to mention our instructors Capt. William C. Trumbower, Ord. Dept., U. S. A., Commanding Officer of the First Ordnance Company, and Capt. Charles H. Keck, Ord. Dept., U. S. A., who acted as executive officer. They were excellent instructors, very patient and had the faculty of making themselves thoroughly understood, imparting to us the knowledge and experience we were after.

We were also fortunate in having with us Colonel Judson, Ordnance and Munitions Officer XII Corps, 4th Army, a graduate of Course D, Command and Staff School, Fort Leavenworth, Kansas. His lectures on those parts of command, staff and logistics, pertinent to ordnance officers and his talks on "combat orders" and the "solution of map problems" were most instructive. Colonel Judson while on an active duty status during these fourteen days, was ordered to active duty without pay at his own request. The time he gave and the patience he displayed clearing up complicated points deserve our gratitude.

The officers are unanimous in extending to Colonel Judson and Captains Trumbower and Keck their sincere thanks and appreciation.

Finally it is recommended that all future active training, be along the same lines as our training this year. Undoubtedly ordnance officers, particularly maintenance company officers, getting this experience will be better fitted to function with the line officers of their respective divisions or corps in time of emergency.

CAPT. CHAS. W. KINGSBURY, Ord. Res., U. S. A.,
*Asst. Division Ordnance and*
*Munitions Officer, 78th Division.*

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### The Aberdeen Training Camp, 1927, as Seen by an Unseen Observer

A FOURTEEN-DAY training period for ordnance reserve officers was held at the Aberdeen Proving Ground from July 31 to August 13, 1927, with one hundred and two officers in attendance. The camp was opened with an address by Brig. Gen. C. L'H. Ruggles, Ord. Dept., U. S. A. The day began at 5:30 in the morning with physical exercises, followed by infantry drill at 7:00; the latter continued until 8:30, and at 9:00 o'clock the instruction was divided into basic and advanced courses, all actual work being completed at 3:00 P. M.

The basic course was for those student officers who had not previously attended the Aberdeen camp, and it consisted of a general system of instruction covering practically all the work done at Aberdeen, this in order that the

student might receive a general knowledge of all activities at the Proving Ground. The advanced course, taken by twenty-three officers, was divided into seven sections comprising mobile artillery, field service, automotive service, ballistics, small arms, ammunition, artillery of position and railway mounts.

The day's schedule was rather strenuous, but time was found in the afternoon for tennis, golf and swimming, as well as an opportunity to go up in an airplane for those who so desired. Ninety-three officers received instructions in pistol shooting, and of these five qualified as experts, four as sharpshooters, and forty as marksmen, the greater majority of the contestants never having handled a pistol before.

Before the close of the camp it was rumored that the wireless had picked up a message from the air which was supposed to have been sent by a "spy" to an ex-war lord residing abroad; the message is alleged to have read:

*To the always most highest und war lord.*

In der air, August 12, 1927.

I vas flying ofer dis Amerika land in my invisible aeroplane, to learn vat dese peoples vould start to do if Your Highness started again. I learned some awful lots off dings, but ven I crossed Aberdeen, I saw some tings vat neffer before in mine whole life I had seen. I saw dem soldiers brafe arrive, some in autos und odders in trains, some vat walked along mit haughty miens, und odders like dey had pains. Dey came in der morning, dey came at noon, und odders came in der night, und I felt I must tell my leader soon dey vas all spoiling for a fight. It made me laugh mine head near off ven by der doctor I saw dese men, for I couldn't describe der shapes off all mit mine bum old fountain pen. Some der vas mit shoulders straight, shust like der giant man, und odders there looked like a vrouw vat is sick from cooking "martzepan." Some der vas mit stomachs on, schust men vat could always cheer, for more to eat, for sauerkraut, vashed down mit lager beer. Der doctor sounded all der lungs, he made dem skip und jump, he examined all der insides too und hunted for der bumps. At last he let dem all go free, for he knew vell in his mind, dot der good vons vould all go ahead und leave der bums behind.

From up in der clouds I looked around, und some more I looked below, to vatch dese mighty soldiers, und learn vat dey didn't know. On Monday dey all valked around, dressed up spick und span, to visit mit each odder und to shake each soldier's hand. Dey thought dot all der days vould be mit pleasures made real gay, und so pass along some fourteen days und den go draw some pay. But heafens, vot a jolt dey got ven der programme vas issued out, ven dey saw dot all der fun vas gone und dot visdom now vould spout. But before dis visdom dey could drink, der body must be taught dot mit gymnastics by der "count" der fat must first be fought. So ven der bugles blew der call, to der drill field dey all vent, where mit counts off von, und two, und three, der stiffest joints were bent. Dis exercising vas den kept up, und in der hearts dese soldiers brafe, felt dot annodder order to bend der legs vould send dem to der grafe. Den breakfast came, but who could eat dose nicest eggs und ham, ven efery bone in her body hurt und all von heard vas "dam." Und breakfast vas hardly in der mouth ven dose bugles blew agin, und on der field dey vent, like doughboys brafe, it vas an awful sin; for ninety minutes dey ran around, wherefer dey vas told, but if dey turned der wrong vay round der teacher sure did scold. Dey came back from dot drill field tired, und thought dey could sit down, but no, dey had to run at double quick, to a lecture off reknown. Dis lecture ofer, dey had to go, out in der broiling sun, to see if der iron vas still around der long hole in some gun. Und after dis dey had some eats, der best ting dot dey knew, so dey settled down und made short vork off dot good old kidney stew. Den came der hour off blissful rest, ven to a lecture dey vent once more, for here dey could close der veary eyes, und sleep und sometimes snore. Dis rest vas all too short a von, for in der fields dey vonce more went, to see if der dust from der aeroplanes hadn't closed up der cannon's vent. At three o'clock dis vork vas done, und to der barracks dey vould march, but der day vas long, der sun was hot, und it knocked out all der starch. Der only ting vot den felt good vas der six-man shower bath, vot fell on thick und thin alike, on der broad und on der lath. Vonce more den all dey had to do, vas to go to der eating house, und eat some off dot gold-fish stew surrounded mit pickled souse. No lectures den dey had at night, so dey didn't haf to run, because all vas finished, dey vas through, der noble day vas done. To bed dey vent, all tired out, but not filled up mit sorrow, because dey knew der day was gone, mit notting to do till tomorrow.

"Customs off der Service" came, und likewise it vent, und dis lesson in dose soldier brains made an awful ragged dent. Und after dis der boss did feel dot dese men sure vas all horses, for he galloped dem around der fields, ofer land und vater courses; "Inspection Trip off Aberdeen," dots vat der Colonel named it, but dots not vat der soldiers said ven dey cussed und surely blamed it. Der sun vas in der heafen high, und on der ground it lingered, mit 115 in der shade, as der soldier his blisders fingered. Der next vat came vas artillery, vot on der seacoast stands, but, by golly, dey mofed it all up here und anchored it on der land. Der teacher told dese soldiers brafe vot dese guns vas all about, but der soldiers couldn't remember a vord, und for more talkings did not shout. Dey turned a crank und pulled a string, und dot gun did jump und bound, ven dey stuck a shell into its breech und fired von glorious round. As if dey hadn't heard enough off dot artillery on railroad mounts, a lecture came right in again und told much more by counts. Den someone said dey knew dot all, but anti-aircraft guns vas new, so dey told it more to dose soldiers brafe util der brains vas all astew. Den came a man vot sure could talk, mit his charge und pressure curves, mit velocity und odder tings, und how dot gun must swerve. He'd hardly done ven annodder chap had to stick in his talking jaw, und he told dem vonce, den ofer again, dot dot shell vas sure to yaw. "Acceptance Test off Ammunition" vas annodder little joke, vot in der soldiers ears dey drummed till der ear drums almost broke. Dis vas hardly done ven up came a man, der soldiers liked him much, mit smokeless powder he did play around, but der powder neffer touched. Der fun began ven dese soldiers brafe mit trench warfare guns did play, but ven der Stokes forgot to fire, it almost lost der day. Der shell vent in und came right out, und on der ground it dropped, und der soldiers brafe, dey ran und jumped, und in der grass dey flopped. Und den dey played some hide und seek mit dot shell's old foolish fuze, to see why it didn't bust und fire und all its bullets loose.

Field artillery vas annodder game vot all dese men played kiddish, but ven dey sat on der carriage brafe dey looked like soldiers Yiddish. Und ven dey came to "Fire Control," und der instruments vot dey use, der soldiers slept, draped ofer der chairs, like dey vas filled mit booze. Mit "Service Rifles und Machine Guns" dey shot holes out in der air, und vasted all dot powder good mitout a thought or care. "Chronographs und Star Gazing," dot vas a game serene, dey played it mit a poker face, you know shust vot I mean; dey played it like dey held a pair off two-spots in der hand, but mit a face dot made you tink dey held aces off all brands. "Bombs und Bombing," dot vas fun, und dey learned a lot down there, from vords und vords, und den some more, vot filled up all der air. But scared I vas ven I saw dem go und get in dem dam tanks, because it made me think off days, now gone, ven we faced dem awful Yanks. Dey got in der doors, und sealed me up, und den off dey vent like lightning, until my brain got sore, und I felt near dead, mit my heartstrings all a'tightning. Dey charged der field like your Highness troops were standing at attention, und der damage dey'd haf done to dose soldiers good, I surely must not mention. So two veeks passed und I saw it all, as in der sky I vavered, vhile dose soldiers brafe in heat like hell maneuvered much und labored. I saw dem all go home vonce more, filled mit visdom und much learning, und I advise your Highness not for war to wish mit too much yearning; for dose soldiers brafe from Aberdeen vould sure be your undoing, und make you on your bended knees to dose dam Yanks go sueing.

Mit all respect, I am, respectfully

Count Johann Heinrich Wilhelm August von Nlersteiner-Liebfraumilch-Johannesberger.

It is impossible to account for the authenticity of the

above, but if true, it gave a very good account of the various activities.

The camp was voted a total success, and the thanks of every student officer present are due to Lieut. Col. C. M. Wesson, Commanding Officer of Aberdeen, Major Bandholtz, Major Gaugler, Captain Campbell, and the other officers of the instruction staff for their painstaking efforts. The camp of 1927 was the best ever! C. H. W.

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### Wiggington E. Creed

Mr. Wiggington E. Creed, a charter member and director of the California Post, Army Ordnance Association, died after a short illness at his home in San Francisco, August 6, 1927. A native Californian, Mr. Creed was born in Fresno in 1877. He was graduated from the University of California in 1898. Following the footsteps of his father, he was admitted to the bar of his native state and became, in 1902, a member of the firm of Titus, Wright and Creed.

Mr. Creed was a firm exponent of industrial preparedness. He was among the first residents of the Pacific coast region to lend active encouragement to the work of the San Francisco Ordnance District. His interest in the affairs of the California Post, A. O. A., was an inspiring incentive to his fellows. In his death the post and the national Association lose the counsel and cooperation of a high-minded and public-spirited gentleman.

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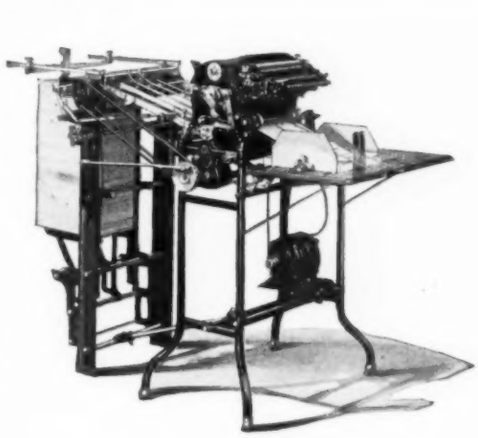
### New York and California Posts, A. O. A., Elect Officers

AT a recent election of officers of the New York Post, Army Ordnance Association, Col. James L. Walsh, Ord. Res., was chosen to succeed Gen. Guy E. Tripp, former President, who died June 14, 1927. Colonel Walsh is Chief of the New York Ordnance District and a Vice-President of the McGraw-Hill Publishing Company. Gen. Samuel McRoberts, President, Chatham-Phenix National Bank and Trust Company, was elected 1st Vice-President; Lt. Col. William I. Westervelt, Ord. Dept., U. S. A., Ordnance Officer, 2nd Corps Area, Governors Island, N. Y., 2nd Vice-President; Lieut. Col. H. B. Machen, Ord. Res., Dept. of Water Supply, City of New York, 3rd Vice-President; and Lieut. Col. R. D. Coombs, R. D. Coombs & Company, 4th Vice-President. Maj. P. R. Faymonville, Ord. Dept., U. S. A., was elected Secretary of the Post and Capt. Chas. H. Keck, Treasurer.

Members of the Executive Committee are, in addition to the officers, Mr. James A. Farrell, Col. Chas. Elliot Warren, C. A. Res., Lieut. Col. E. L. Sherwood, Ord. Res., Maj. Earl McFarland, Ord. Dept., U. S. A., Maj. C. E. Davies, Ord. Res., and J. M. Boyle.

At the annual election of officers of the California Post, held in October, the following were elected: Pliny E. Holt, Director, Caterpillar Tractor Co., President; Charles N. Black, with Ford, Bacon and Davis, Engineers, Vice-President; Directors: J. D. Grant, President, Columbia Steel Co.; Fred Boegle, Jr., Secretary, California Manufacturers Association; Col. Bruce Cornwall, Ord. Res., Chief, San Francisco Ordnance District; Lt. Col. Theodore J. Hoover, Ord. Res., Dean of Engineering, Stanford University; and Samuel Kahn, President, Market Street Railway.

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# Professional

**Discussion of "A Standard Method for Measuring Small Arms Targets" by Capt. F. J. Jervey, Ord. Res., U. S. A., in July-August, 1927, issue of Army Ordnance.**

THE standard method for determining mean radius and other target measurements as outlined by Captain Jervey (ARMY ORDNANCE, July-August, 1927, page 10), is subject to appreciable simplification. The determination of mean radius measurements in connection with accuracy tests of small arms or small arms ammunition, is always considered to be a tedious task which is worth avoiding if possible. Captain Jervey has outlined the history of the various methods used in comparing the efficiency of small arms ammunition and has reached conclusions which are quite sound, but it is possible to simplify the mechanics of the method which he proposes.

Consideration of the tabulation given in Fig. 3, page 13, shows immediately that only vertical and horizontal measurements from any set of base lines, preferably those selected, are sufficient to permit the computation of other quantities such as horizontal deviation, vertical deviation, and radius from center of impact.

An improved tabulation (see below) has been prepared. In order to prepare this tabulation, only twenty measurements are necessary, whereas Captain Jervey's tabulation requires fifty measurements. If these measurements could be made easily and quickly this difference in number of measurements required would be of little importance, but the measurements which Captain Jervey requires are made to hundredths and sometimes to thousandths of an inch with the help of only an ordinary scale.

As a substitute for thirty of Captain Jervey's measurements the writer proposes a simple computation which requires only the ability to add, subtract, divide, and to make use of a table of squares or square roots.

The details of construction of the tabulation are as follows:

The first three columns are the same as Captain Jervey's. Column (4) is obtained by subtracting each figure in column (2) from the mean, 2.57, of column (2). Column (5) is likewise obtained from column (3) by subtracting each figure in column (3) from the mean, 2.84, of column (3). Column (9), the radius, is obtained by use of the rule that the radius from the center of impact is equal to the square root of the sum of the squares of the horizontal and vertical deviations. Columns (6) and (7) are obtained by squaring the corresponding figures of columns (4) and (5). Column (8) is obtained by adding the corresponding figures of columns (6) and (7). Column (9) is obtained by taking the square roots of the corresponding figures in column (8). In all cases mean values where desired are obtained just as Captain Jervey obtains his mean values.

With reference to the first part of Captain Jervey's article in which he discusses the battle of "mean error," the following brief comment is submitted. If two projectiles are at all similar in ballistic characteristics the difference in the effect of a cross wind at ranges under a thousand yards may be neglected. Of course the wind effect on the horizontal measurement may be greater than on the vertical measurement, but if the comparative test is fired in a proper manner, this difference in effects should be of little importance in determining the relative merits of two or more types of ammunition. An accuracy figure which is based to a large extent on the effects of accidental variations in the cross wind is likely to be a poor figure. In an analogous test of artillery ammunition practically no consideration is given to dispersion in deflection, accuracy in range being the factor which is considered to be of importance. Therefore I conclude that the radius method is not quite all that it is cracked up to be.

By determining all of the possible or desirable quantities as Captain Jervey suggests, it may be possible to reach ultimately some comparative conclusions concerning them.

1ST LT. P. SCHWARTZ, Ord. Dept., U. S. A.,
*Fort Bragg, N. C.*

| | MEASUREMENTS | | COMPUTATIONS | | | | | |
|---|---|---|---|---|---|---|---|---|
| Shot Hole | Vertical | Horizontal | Vertical Deviation | Horizontal Deviation | $(VD)^2$ | $(HD)^2$ | $(VD)^2+(HD)^2$ | Radius |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| 1 | 0.00 | 6.33 | 2.57 | 3.49 | 6.60 | 12.18 | 18.78 | 4.33 |
| 2 | 2.18 | 4.02 | 0.39 | 1.18 | 0.15 | 1.39 | 1.54 | 1.24 |
| 3 | 5.30 | 6.47 | 2.73 | 3.63 | 7.45 | 13.18 | 20.63 | 4.54 |
| 4 | 6.84 | 3.36 | 4.27 | 0.52 | 18.23 | 0.27 | 18.50 | 4.30 |
| 5 | 3.42 | 1.92 | 0.85 | 0.92 | 0.72 | 0.84 | 1.56 | 1.25 |
| 6 | 2.64 | 1.08 | 0.07 | 1.76 | 0.00 | 3.09 | 3.09 | 1.76 |
| 7 | 1.60 | 0.60 | 0.97 | 2.24 | 0.94 | 5.02 | 5.96 | 2.44 |
| 8 | 0.64 | 0.00 | 1.93 | 2.84 | 3.72 | 8.07 | 11.79 | 3.43 |
| 9 | 1.85 | 2.10 | 0.72 | 0.74 | 0.52 | 0.55 | 1.07 | 1.03 |
| 10 | 1.20 | 2.55 | 1.37 | 0.29 | 1.88 | 0.08 | 1.96 | 1.40 |
| | 25.67 | 28.43 | 15.87 | 17.61 | | | | 25.72 |
| Mean | 2.57 | 2.84 | 1.59 | 1.76 | | | | 2.57 |

### Battleship Sunk by Bombs Salvaged

WHAT was once the battleship Alabama, now merely a hulk of twisted steel and gaping holes that is kept afloat only by the diligent work of a wrecking crew, lies anchored in the private ship channel that leads to the plant of the Union Shipbuilding Company at Fairfield.

"With every rise of the tide the former pride of the United States Navy is pulled closer to the company's dock. When it eventually reaches the berth that is being prepared for it, the Alabama will be cut, burned and mashed into pieces of steel five feet long and eighteen inches wide.

#### SUNK BY AIRPLANE BOMBS

"'Battleships come and battleships go,' R. C. Cowles, manager of the Fairfield firm, said yesterday, 'but steel, if it can be salvaged, goes on forever. The twisted hulk of the Alabama, in fragments of course, will be sent to the steel mills, remelted and again used.'

"The Alabama was sunk by airplane bombs September 25, 1921, in the Chesapeake Bay, six and one-half miles from Tangier Island. The hulk was sold for junk to a New York corporation which resold it to the Baltimore company.

"On October 21, 1926, the Fairfield firm sent a wrecking crew under the direction of G. J. McVicar and Capt. Paul F. Cullison, of the company's tug Arbutus, to raise the Alabama and bring it to Baltimore. An examination of the hull first was made by two divers, Carl Anderson and Nils Kwick.

#### TWO HOLES MADE BY BOMBS

"The divers reported that the vessel had been sunk by two holes. One, they said, was seventy-five feet wide and extending from twelve feet below the water line, abreast of the port engine room, to the keel, and the other forty feet wide and extending from two feet above the water line, abreast of the after starboard quarter, almost to the keel.

"According to engineers working for the company, the former bomb would have put the port engine out of commission and the latter blew off the starboard propeller. The Alabama was a twin-screw vessel and the engineers said the two bombs that caused the damage would have put her engines out of commission immediately and that they caused her to sink in a few minutes.

"In the damage listed by the Navy Department following the bombing experiments no mention was made of the explosion that wrecked the port engine room. The vessel listed to port when she settled and only the damage done by the explosion on the starboard quarter which appeared above water was mentioned in the department's report.

#### BLAST TWISTS UPPER DECK

"Naval officials said at the time that the Alabama had been sunk by a 2,000-pound bomb that made a direct hit near the mainmast. The company's engineers said this bomb penetrated the first deck, but was stopped ten feet below when it struck the armor deck and exploded.

"The upper deck was twisted by the blast and was put in such a position that the forward turret would have been unable to fire directly ahead. Mr. Cowles said he believed that that explosion would not have affected the engines and could not have caused the ship to sink.

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"Neither of the two bombs that caused the sinking struck the Alabama, the company's engineers said. Each entered the water within a few feet of the vessel and exploded several feet below the surface. The engineers said the bombs undoubtedly were moving on a tangent with the surface of the water and were almost directly under the Alabama when they exploded.

HOLES PATCHED

"If it were true that the bombs that caused the sinking were those that did not strike it rather than the one that made a direct hit, the engineers pointed out, the statements of Col. William R. Mitchell concerning the vulnerability of battleships to airplane attack would be strengthened greatly.

"The wrecking crew under Mr. McVicar patched the two holes. In each instance a steel plate had to be buckled to the side of the vessel and then the water pumped from the inside."—*Baltimore Sun*, September 14, 1927.

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### Tanks and Motorized Artillery Participate in Cavalry Maneuvers

LONG columns of troops, including cavalry, tanks, motorized and horse artillery, engineers, machine guns, and pack, wagon and motor trains, marched overland from four points of the compass, converging on the concentration area in the vicinity of Marfa, Texas, where maneuvers of the First Cavalry Division began Tuesday, September 20th, under the supervision of the Division Commander, Brig. Gen. Edwin B. Winans, to test the capabilities and limitations of motorized transport operation with cavalry in the field.

It is estimated that the total mileage covered by all troops, in their marches to and from the maneuvers, easily exceeded 3,000 miles. These marches constituted a severe test of equipment, personnel, and animals. For the mounted organizations the 250 to 300 miles on the road brought the troops into the area well hardened for the rapid maneuvering which followed. The march over Texas roads, typical of most of those along our Southern border, provided ample opportunity to observe the adaptability to rough field usage of the thirteen different packs by means of which the cavalry carries its cooking outfits, radio, rations, machine guns, pioneer tools, demolition kits, picket lines, ammunition and other equipment. The operation of the cargo trucks and technical vehicles of the division, augmented by the forty-three trucks of Motor Transport Company No. 49, and one Motor Repair Section from Fort Bliss for supply purposes, received close attention of observers.

Participation in the exercises of a platoon of the Second Tank Company from Fort Sam Houston was in keeping with the intention of the War Department to experiment with tanks in conjunction with cavalry, in an effort to develop a fast moving tank suitable for incorporation in the armament of a cavalry division. To arrive on the scene of maneuvers, the tanks from San Antonio first covered a distance of 425 miles in trucks. Considering the round-trip of 850 miles, and the weight of the tanks, six tons, this march may be considered one of the most remarkable on record. On account of the tremendous weight of the truck and its tank, small bridges along the route were strengthened to provide safe passage of the load. Valuable information was deduced as a result of the tank participation,

which portends a future assistance to cavalry in mounted, dismounted and in combined mounted and dismounted attacks.

Of particular interest was the march of a motorized battery (portee) of field artillery from Fort Sill, Oklahoma, commanded by Capt. Edward F. Hart, and the part it subsequently played in the maneuvers. The transport of this battery consists of 3-ton Liberty trucks with trailers. For purposes of road marching, the 3-inch gun with its caisson is carried on the truck, while the trailer pulled by the truck, transports the tractor. Preparatory to going into action, gun, caisson, and tractor are unloaded and the battery proceeds across country to its destination under power of the tractor. The march of this command, covering a distance of 650 miles each way, was rigorous test of the matériel. Making from sixty to seventy miles daily, over roads sometimes unimproved, the motor equipment was taxed to the limit of its endurance. The employment of a battery of portee artillery furnished an excellent opportunity for comparison of its capabilities as compared to the horse artillery of the Cavalry Division and in a country sufficiently difficult to make the conclusions of real value.

Air forces were represented by the Twelfth Observation Squadron, commanded by Capt. C. H. Reynolds of Fort Sam Houston, Texas, and one photographic section. The air force played an important role, especially on missions of distant reconnaissance, artillery liaison, and in the attack of ground troops. For this reason, close and dependable communication between ground and air troops was of utmost value, and, accordingly, all planes of the observation squadron were with radio.

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**Fire at Curtis Bay Ordnance Depot, Curtis Bay, Maryland**

ON September 23rd, about seven o'clock in the evening, a fire was discovered in a platform pertaining to the salvage operations now going on at the Curtis Bay Ordnance Depot at Curtis Bay, Maryland, near Baltimore. To decrease the amount of explosives in this depot the Ordnance Department had undertaken the work of unloading a number of shells in storage there. Several hours after the day's work was completed a fire broke out and burned the operating platform where explosives were in process of removal from shells. The heat of this fire caused the explosion of a small number of 6-inch trench mortar shells which were standing on the platform. Probably not more than one dozen shells exploded. The fire was at once kept under control; there was no spread of fire to any adjacent material; the plant at no time was threatened. There were no injuries and the property damage connected with this fire was small.

The unloading of this ammunition is in line with the policy of the Ordnance Department in removing from Curtis Bay all explosive hazard at as early a date as possible. All black powder, bulk explosives and TNT had been removed from the depot.

Safety measures are always taken to minimize the effect of such fires and to conduct the salvage operation at places where the danger of spreading to magazines is remote. At the Curtis Bay Depot the salvage operations are conducted at several hundred yards distance from any other installation so the danger is especially minimized.

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# Books

**Napoleon in Captivity.** Translated and edited by Julian Park. New York: The Century Company. 1927. $3.00.

THE English having decided that Napoleon's place of exile was to be Saint Helena, the European powers by treaty of August 2, 1815, were invited to send commissioners there "to assure themselves of his presence." Count Balmain was the Russian Commissioner from 1816 to 1820. His reports and letters to his government are the subject matter of this book.

Although the reports of Count Balmain were written by one who never saw Napoleon, they give an account of contemporary life on the "rock" probably unexcelled by the writings of any of the eyewitnesses who have left a record. The actions and words of the prisoner as reported by the orderly or as heard by those of Napoleon's entourage are recorded and thus a fairly adequate picture of this important period of the Emperor's life is presented in a direct, often gossipy, fashion but none-theless in a manner which makes accurate history.

Julian Park has translated and edited these documents in a most satisfying way. His work is said to be the first complete English translation of the Balmain document which, it is also claimed, is probably the last piece of Napoleonic source material that will ever be published.

**We.** By Col. Charles A. Lindbergh, A. C. Res., U. S. A. New York: G. P. Putnam's Sons. 1927. $2.50.

BY the time Colonel Lindbergh returned to this country, the fact of his epoch-making flight, together with his dignified bearing in the many difficult situations abroad, had aroused the enthusiastic admiration of the entire country. It is not surprising then that this autobiography has been seized upon by thousands in order to learn the origin of such a man, his early training, his methods of work, and the reasons of his success. The answer is to be found in this book, which is an interesting and modest recital of the author's early efforts to become an aviator; of his training under the Army Air Corps; of his work as an air mail pilot; and finally, the preparation and successful completion of his flight to Paris. Lindbergh may be "lucky," but hard work and application to a single purpose account for his success.

The foreword written by Mr. Herrick is a note of high appreciation of Lindbergh's qualities. Lindbergh's own account of his life work is supplemented by a description of the reception accorded him in the various capitals subsequent to his flight.

**Soldiers and Statesmen: 1914-1918.** By Field-Marshal Sir William Robertson. New York: Charles Scribner's Sons, 1926. Two volumes. $12.00.

THE conduct of modern war by democratic governments, with the British Government in the World War as the principal example, is here critically discussed by the man who was Chief of the Imperial General Staff during most of that war. The burden of the author's essay is that while his political superiors gave him this important title they withheld the authority and responsibility theoretically and normally associated with that office; the results of this policy are shown by the history of the war before 1918.

Conflict between soldiers and statesmen in the managemen of war has always occurred to some extent, but the inefficieney and lack of coordination of the British Government which are here unfolded are almost unbelievable. Each minister was in fact conducting his own war, protected by the vested interests of his department and feebly coordinated by various transitory committees instead of by a strong executive. The author shows plainly that there was neither unity of political command, unity of plan, nor concentration of forces and that no substantial success was achieved until these first principles of war were adhered to. Conditions were even worse with the Allies as a whole. Much space is also devoted to the question of the demarcation between civil and military authority, that is, the hazy border line between policy and strategy.

The conduct of each major campaign is examined in detail and is well documented. There is a good index. This work is a military and political classic which may be read with interest and great profit.

**Business Cycles—The Problem and Its Setting.** By Wesley C. Mitchell. New York: National Bureau of Economic Research. 1927.

IN the above work, Professor Mitchell brings to bear the same characteristics of careful, painstaking and clear-minded scholarship which have already made him an international authority in the field of economics. As the

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subtitle indicates, the present work is chiefly concerned with a review of the principal theories which have been put forth to explain business fluctuations and an inquiry, from the three points of view of economic theory, statistics and business reports, of exactly what is or should be connoted by the term "business cycle." A second volume on "The Rhythm of Business Activity," is promised shortly. The present work will at once assume an authoritative position in the literature of the subject.

**The Dardanelles Expedition.** By Capt. W. D. Puleston, U. S. Navy. Annapolis: U. S. Naval Institute. 1927. 2nd Ed. $2.80.

CAPT. PULESTON has brought up to date in this edition his excellent treatise of the Dardanelles Campaign. By studying such books as have been published on the subject he has been able to make this interesting volume, which he terms "a condensed study" as nearly authoritative as possible. The activities of the land forces as well as of the naval forces are clearly indicated in the text and in the many illustrations. They are also skillfully analyzed. The deductions concerning the condition of the Turkish forces agree favorably with the facts as indicated in General von Sanders' *Five Years in Turkey*, which has recently been published in English by the same publishers.

The author is opposed to nontechnical men, such as Churchill, assuming the duties and responsibilities concerning military and naval affairs which could be best handled by men trained for the purpose. Perhaps he dislikes Churchill in particular for he stresses his shortcomings by ending the book with, "It is doubtful if even Great Britain could survive another World War and another Churchill." The failure of the campaign was shared by other blunderers in its execution and had no errors been committed it is reasonable to conjecture that it would have been successful to a certain extent. At any rate fate played a major part in this campaign.

The exploits of the president of Turkey, Mustapha Kemal, at Chunuk Bair and elsewhere are among the many interesting features of this delightful and authoritative work.

**History of American Foreign Relations.** By Louis M. Sears. New York: Thomas Y. Crowell. 1927. $3.50.

GEORGE ELIOT in "Romola" remarks that "To manage men one ought to have a sharp mind in a velvet sheath"—a very apt definition of diplomacy. The sharp minds and the velvet (?) sheaths of our American diplomacy are the subject of Professor Sears' historical narrative. After one finishes this book he must congratulate the students, past and present—to whom the work is dedicated—on their good fortune at having had and having so learned and versatile a teacher in this all important subject.

To say that Professor Sears' book is history in the modern manner may seem slightly flippant. The comment is not meant for such interpretation. Rather it is intended that the author by his keen sense of analysis, his succinct manner of presentation and his facility of accurate statement has given us a history that seems well suited to the modern taste for, fact though it be, it reads with the fascination of fiction. His chapter on "Great Secretaries and Minor Presidents" and those on "The Triumph of

Imperialism" and "A New Giant in the World" we suggest as gems of reading in a volume replete with such jewels to all who are tired of the laborious histories of our diplomacy and whose reading sense demands their history served to them tastily garnished and palitably prepared whether the dish be to their liking or not.

**China and Foreign Powers, An Historical Review of Their Relations.** By Sir Frederick Whyte. London: Oxford University Press. 1927. 2 s. 6 d.

THIS study was prepared for use at the second conference of the Institute of Pacific Relations held at Honolulu in July, 1927. It presents in a clear and concise manner the British relations with China and should be helpful to those interested in the course of events in the Far East. The period covered extends from 1793 to the present time. Nine appendices are included which are diplomatic documents and others necessary for a complete understanding of the questions involved.

**Explosifs, Poudres Gaz De Combat—Lecons Professees A La Faculte Des Sciences De Lille.** By Paul Pascal. Paris: Librairie Scientifique—J. Hermann. 1925.

IN his preface Professor Pascal states that the book is an almost literal reproduction of his lectures at Lille. The students of this university are to be congratulated for having such instruction.

This book of about 300 pages covers: the theory of explosive reactions, the manufacture of various types of explosives and the history, manufacture and tactical use of combat gases.

While intended primarily for the undergraduate student, there is much of interest to the Ordnance Officer and explosive manufacturer.

The final section of the book is devoted to a brief consideration of Lewisite and the closing paragraph, quoted herewith, is food for thought:

"There is no doubt that the constituents of Lewisite present considerable interest for future wars."

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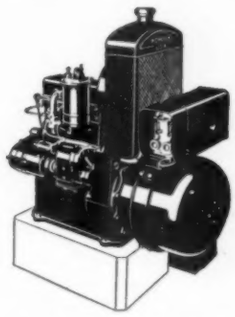
**Editor's Note:** Readers are referred to an excerpt, from this volume published in the September-October, 1927, issue of ARMY ORDNANCE, page 103 (Vol. VIII, No. 44). The excerpt was translated by Maj. Aiken Simons, C. A. C., Res., Wilmington, Del.

**From Bismark to the World War, A History of German Foreign Policy, 1870-1914.** By Erich Brandenburg. Translated by A. E. Adams. London: Oxford University Press. 1927. $7.00.

PROFESSOR BRANDENBURG has written and Miss Adams has translated the most comprehensive account of Germany's foreign policy during the forty or more years preceding the World War which has yet been published. It is a very creditable work for both of them. The author has drawn on the archives of the German Foreign Office exhaustively and attempted to point out the causes of the World War so far as his sources of information will disclose. At the same time he stresses the fact that the soundness by his analyses and conclusions will be demonstrated only by similar airing of the diplomatic correspondence of Russia, England and France.

Faulty diplomacy and undesirable characteristics of the various actors in this vast drama are indicated without bias. The well known German viewpoint prevails, naturally, and in the final analysis we have the individuals,

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Iswolski and Poincaré convicted of occasioning the war; the immediate overt act which initiated the whole affair being the Russian mobilization.

References to sources are given, for the most part, but are neglected in the chapters dealing with the Sarajevo disaster and later. Ludwig in his *Wilhelm Hohenzollern* finds in what he calls the Kaiser's "marginalia" jotted down on various documents a different policy than the present author discloses and one which the pro-Allies adherents are more apt to believe. Germany's misdeeds cannot be excused under the plea of military necessity. A very interesting and valuable history.

**China Yesterday and Today.** By Edward Thomas Williams. New York: Thomas Y. Crowell & Co. 1927. Revised Edition, $4.50.

THIS is an exceptionally able and well written book and worth the careful reading of all who are interested in the Far East—past as well as present. Professor Williams gives clear and vivid pictures of China from her primitive days to the present. One is made to feel the charm of the people and their country, their loyalty to their beliefs—misguided as some of them seem to us—their splendid stoicism, their many superstitions as well as their numerous lovable qualities.

There are several chapters devoted to the religions of China, Confucianism, Buddhism and Taoism, which are very illuminating in helping one to comprehend the character and outlook of her people.

The present struggles between the people of North and South China, with the desire on each side for controlling the affairs of state, the tremendous differences between them, are better understood after reading this comprehensive book. Professor Williams shows how these differences arose from the very beginning and how they have continued until now, due to different racial ancestors, to natural barriers and to lack of internal communication.

The author makes one feel there is much that the East can offer the West in art and culture and much that the West can give to the East in practical and scientific learning.

**Five Years in Turkey.** By Gen. Liman von Sanders. Annapolis: The United States Naval Institute, 1927. $3.50.

GENERAL VON SANDERS, Chief of the German Military Mission in Turkey from December, 1913, to January, 1919, describes Turkey's World War efforts, giving particular emphasis to the Dardanelles and Palestine campaigns. The Kaiser's desire to eliminate political activity from her army was not accomplished and the author was continually harassed during critical operations by unwarranted political interference and only by extreme measures was he able to retain sufficient military control.

The already heated controversy concerning the failure of the Allies at Gallipoli will gain added impetus from this intimate account of the deplorable condition of the Turkish lines of communication, equipment, and military discipline. Many readers will surmise that Churchill's contentions are correct and that this campaign should have been successful from the start and certainly later when von Sanders was committed to the Palestine campaign.

This book is quite acceptable historically and the intimate pictures of personalities, especially the references to the military activities of Mustaphal Kemal Pasha, the President of Turkey, add greatly to its charm.

The English reading public is indebted to Col. Carl Reichmann and to the U. S. Naval Institute for making this account thus accessable.

**Storm Fighters: True Stories of the Coast Guard.** By John D. Whiting. Indianapolis: The Bobbs-Merrill Co. 1927. $2.00.

MR. WHITING draws a very vivid picture of the hazardous duties of the Coast Guard in its eminently heroic and praiseworthy efforts of life-saving. He sketches the development of the equipment used and of the organization perfected. For the reader who has encountered a storm at sea little is needed to start his blood coursing through his veins; for him the author is not writing, perhaps, but rather for those who have not had the misfortune or opportunity to see a broad expanse of water in a fury. For them the storm-tossed Coast Guard in action is gloriously portrayed.

The Coast Guard has not enjoyed widespread publicity concerning this portion of its activities wherein great credit is due so that it is very fortunate that a writer with so facile a pen should chant their praises. The book is charmingly written, instructive and interesting.

**The Opinions and Reflections of Napoleon.** Edited by Lewis Claflin Reed. Boston: The Four Seas Company. 1926. $5.00.

WHILE this volume contains little that is new of the writings and discourses of the great Corsican, the treatment of the subject matter is unusual in that the opinions of Napoleon are gathered under categorical headings covering a wide range of subjects. There is also a general introduction and a synopsis of the principal events of Napoleon's life.

As a reference book the volume at hand should have considerable value. In his role of painting the lily, the editor, by interposing his own academic observations, mars an otherwise remarkable treatise. Surely the opinions and reflections of the First Consul could stand or fall on their own merits. In trying to embellish them the editor detracts greatly from what is otherwise Napoleon's very striking analysis of the world of his day.

**The Great Delusion: A Study of Aircraft in Peace and War.** By Neon. New York: Lincoln MacVeagh: The Dial Press, 1927. $4.00.

THE author, writing impersonally as Neon, discusses the limitations of airplanes and airships and concludes that the many claims advanced by adherents of enlarged flying activities for peace and war are greatly overrated. The publishers state that the author is a high official in the British admiralty. He is undoubtedly well posted on the British viewpoint and on the particulars of flying accomplishments. He points out that the ethics of warfare preclude the gassing and bombing of noncombatants by air forces, which must be considered to be just as humane as other agencies. He also indicates the economic questions which limit commercial aviation and air warfare materially.

While the reader must agree to many of the more or less obvious limitations cited it would appear that not

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sufficient weight is given to the rapid advance in the flying art and in airplane design and performance. The mission of the flyer commercially in mail transportation and in mapmaking in peace and war are signally neglected.

This book is well written and should develop deep thought on this infant industry and science which will serve to advance air transportation for its war and peace purposes and should be read by those interested therein. It is believed that his book will have served its purpose from the author's standpoint if interest in aviation is stimulated and if development for its utilization is directed towards those uses for which it is best adapted and in those commercial fields which justify its utilization from an economic viewpoint.

**Queen Mary of England—A Life and Intimate Study.** By Kathleen Woodward. New York: George H. Doran Company. 1927. $5.00.

THIS book is almost exclusively concerned with the life and activities of the present Queen of England and touches most meagerly on the many varied personages who surrounded her and influenced her character and actions. The more critical reader demands more light on such contemporaries in a biography of this kind. The author presents a character with no faults and with many admirable attributes. Queen Mary's management of the royal household and of the many royal residences is portrayed as being efficient and masterly.

Many of the Queen's activities center about the welfare of the working classes for whom she has done much to make their lives more endurable. In relieving suffering and providing comforts for her more unfortunate subjects she exposes the kindly sympathetic side of her nature which is ever uppermost. Her war work was, and her public acts are, almost entirely of this nature and if she plays any part in England's political life or foreign policies it is not here recorded.

This book is admirably written and the subject matter well treated. However, the Queen is idealized to such an extent as to raise the question whether a subject can write to the best advantage of her sovereign during the lifetime of the latter. It is believed that such a book can be written best in retrospection.

**Annie Oakley—Woman at Arms.** By Courtney Ryley Cooper. New York: Duffield & Company. 1927. $2.50.

THIS is a biography of Annie Oakley, "Miss Sureshot," who began her career as the first woman in the wild west show of Buffalo Bill. The book abounds with incidents of interest to the shooting confraternity. Here is a sample quotation: "Another event which caused the breath to move a little faster a generation ago was when Annie Oakley, in her buckskin costume and trusty rifle, stepped forth, shot at the thin edge of a playing card held in her husband's hand, and sliced it in two. Or knocked a dime from between his thumb and forefinger at thirty paces. Or hit a swinging ball as it circled about his head at the end of a string. Once, in a contest, with a .22 rifle, she fired 1,000 shots at composition balls thrown into the air. Out of the thousand she hit 943 times, which still remains a mark for other women to shoot at, as Will Rogers would say."

Obviously such a volume contains descriptions of many interesting happenings in the life of one who, until her recent death, was America's foremost rifle-woman.

# Patents

**Brief Descriptions of Inventions of Interest to Ordnance Engineers**

*Compiled by W. N. Roach, Chief, Patent Section, Office of the Chief of Ordnance*

Recent patents relating to ammunition include:

Andre Varaud has been granted reissue patent 16,703 for a clockwork for mechanical fuzes for artillery projectiles. The main object of this invention is the provision of a cylindrically wound spiral arranged transversely of the fuze and preferably perpendicular to the axis of rotation with means for supporting the spiral at the moment of discharge, together with a balance having oscillations of relatively large amplitude.

Patent No. 1,639,075, for an aerial bomb fuze, has been granted to Frederick W. Bold, assignor to Chas. H. Pearson. This invention relates to an improved starting means for the timing train, improved means for preventing access of dirt and moisture to the timing mechanism, improved means for setting the fuze, and an improved safety means for preventing accidental detonation.

Andre Varaud, assignor to Tavannes Watch Co., S. A., of Berne, Switzerland, has been granted patent No. 1,640,165 for a clockwork-operated mechanical fuze for shells and like projectiles. The main object of this invention is the provision in a mechanical time fuze of a driving spring of greater length together with a mechanism to permit sufficient revolutions, in setting the fuze, to wind the spring thoroughly and to permit the spring to unwind, during the travel of the projectile, to cause the mechanism to make sufficient revolutions in the opposite directions to rotate the member controlling the unlocking of the striker.

George W. Beatty, of the Office of the Chief of Ordnance, has been granted patent No. 1,640,392, for a fuze-setting machine. The main object of this invention is the provision of a fuze-setting machine which is normally locked against operation until the insertion of a round.

Patent No. 1,640,892, for a pyrotechnic signal has been granted to Harry F. Gammeter. The main object of this invention is the provision of a safe and efficient signal containing means for automatically igniting the same.

Patent No. 1,641,939 for a mechanical fuze for artillery projectiles, has been granted to Andre Varaud. The main object of this invention is the provision of mechanism for permitting several winding turns in setting the fuze so as to store up much greater driving force in the power spring.

M. Varaud, assignor to Tavannes Watch Co., S. A., of Berne, Switzerland, also has been granted patent No. 1,642,520, for another mechanical fuze for artillery projectiles. This invention aims to provide a frame for the clockwork mechanism which may be centered accurately in the fuze body and firmly held in such position.

Oliver Boden, assignor to Vickers, Ltd., of West-

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minster, England, has been granted patent No. 1,642,837, for a time fuze for projectiles. This invention relates to powder train time fuzes having two or more rings and aims to provide a closing disk or patch for the vents of the lower timing rings which are held in place by a retaining member capable of permitting the disks to be blown out by the gases generated on the burning of the powder train but held against removal by the action of centrifugal force.

Patent No. 1,643,385 has been granted to Theodore Lafitte, for an airplane bomb with a safety device. This invention aims to provide a bomb equipped with a wind wheel which will not operate until the bomb has assumed a substantially vertical position and has attained a predetermined speed.

### Artillery

A patent of recent issue which relates to artillery is as follows:

Eugene Schneider, assignor to Schneider et Cie, of Paris, France, and to Joseph Louis Routin of the same place, has been granted reissue patent No. 16,734, for an apparatus for controlling the firing against aerial objectives. This invention provides means for mechanically and electrically recording and compounding ballistic data, means connected with the aforesaid means for transmitting to indicators located adjacent the gun, the correct data including windage corrections, and means interposed between the indicators and the training and elevating mechanisms of the gun whereby the gun is laid to the proper angles of elevation and train.

### Small Arms

George Tansley, assignor to Colt's Patent Fire Arms Company, of Hartford, Conn., has been granted patent No. 1,638,068, for a magazine safety device for automatic pistols. This invention provides means for breaking the connection between the trigger and sear when the magazine is withdrawn so as to render the arm safe even though a cartridge has been left in the chamber.

Cesare Soncini, assignor to Societe Italiana Ernesto Breda, of Milan, Italy, has been granted patent No. 1,639,277, for a removable barrel mounting for automatic firearms. This invention aims to provide means for firmly locking the barrel in place or unlocking and removing the same without the use of any tools.

Crawford C. Loomis, assignor to Remington Arms Company, Inc., has been granted patent No. 1,638,351, for a firearm the main object of which is the provision of a safety device which locks the sear against movement.

Patent No. 1,639,425 has been granted to Vincenzo Capolupo, for an automatic firearm. The main object of this invention is the provision of an attachment for an automatic pistol whereby the pistol will continue to fire as long as the trigger is retained in firing position.

Maj. Samuel G. Green, Ord. Res., U. S. A., of the Office of the Chief of Ordnance, has been granted patent No. 1,639,846, for a tripod mount. The main object of this invention is the provision of a light yet stable mount for high angle fire so constructed and braced that the resultant thrust transmitted to the mount will be well within the base of the tripod.

Major Green also has been granted patent No. 1,643,491, for a mount for guns the main object of which is the provision of a novel socket for the gun-carrying standard.